ARCHIVES OF OTOLOGY.

HERPETIC INFLAMMATIONS OF THE GENICULATE GANGLION. A NEW SYNDROME AND ITS AURAL COMPLICATIONS.[1]

By J. RAMSAY HUNT, M.D., of New York,

CHIEF OF THE NEUROLOGICAL CLINIC AND INSTRUCTOR IN NERVOUS DISEASES IN THE CORNELL UNIVERSITY MEDICAL COLLEGE, NEW YORK.

(*With two illustrations on Text-plate II.*)

INTRODUCTION.

THE subject of this communication was presented at a meeting of the American Neurological Association held in Boston, June, 1906. A further presentation was made at the conjoint meeting of the New York and Philadelphia Neurological Societies held in New York, March, 1907. These dealt in detail with the neurological aspects of the subject. In the present communication the otological features will be emphasized more particularly, especially the otalgia, the herpes zoster of the concha and external auditory canal, and the symptoms of Ménière's disease which represent important aural complications of the affection.

Briefly, the syndrome is dependent upon a specific herpetic inflammation of the geniculate ganglion, situated on the facial nerve in the depths of the internal auditory canal in the entrance to the aqueduct of Fallopius. The

[1] Read before the Section on Otology of the New York Academy of Medicine, April, 1907.

simplest expression of this inflammation is to be found in the herpes zoster of the tympanum, auditory canal, and the concha (*this representing the zoster zone for the geniculate ganglion*). Because of the proximity of the facial nerve and the terminations of the auditory nerve, neural complications are not infrequent: peripheral facial palsy, tinnitus aurium, deafness, and symptoms of Ménière's disease. The pathology of the affection does not differ from that of true herpes zoster, or zona. This, as has been shown by the elaborate pathological studies of Head and Campbell, depends upon a specific inflammation of the posterior spinal ganglia. While one ganglion is usually the seat of the chief manifestation of the disease, the neighboring and adjacent ganglia may also show slight inflammatory changes. Evidence of this multiplicity of lesions is shown clinically by the occurrence of double bilateral and, rarely, triple forms of zona, which are especially frequent in the region of the face, head, and neck.

The facial nerve is a mixed nerve. Its sensory ganglion is the geniculate; its afferent root is the nerve of Wrisberg; its efferent, the facial nerve proper. The peripheral divisions of the geniculate ganglion are the great and small superficial petrosal nerves and the external petrosal nerve, the latter passing to the carotid plexus of the sympathetic; the former, to Meckel's and the otic ganglia respectively. Furthermore, both the greater and lesser superficial petrosal nerves participate in the formation of the tympanic plexus through the great and small deep petrosal nerves. (See Fig. 1.) As the geniculate ganglion contains cells of the spinal ganglion type, it, like the Gasserian ganglion, may properly be brought within the realm of the specific inflammation of herpes zoster.

The ganglionic representations of the cephalic extremity of the body roughly outlined are as follows: The Gasserian ganglion for the face, the geniculate ganglion for the concha and auditory canal, the second,

third, and fourth cervical ganglia for the occiput and neck,—any zoster inflammation of these giving rise respectively to herpes facialis, herpes auricularis, and herpes occipito-collaris. As the tendency of the specific inflammation of zona is to produce inflammatory changes in a series of ganglia, although its chief manifestation is in a single ganglion, it would follow that when the chief focus is in the Gasserian ganglion, an inflammatory reaction might also occur in other ganglia of this series (the geniculate, second and third cervical ganglia).

In this manner I would explain that group of cases with facial palsy and acoustic symptoms in which the eruption is distributed over the face or neck, the zone for the geniculate ganglion itself remaining free. I have collected sixty-one cases of true herpes zoster including five personal observations presenting a peripheral facial palsy, in which the eruption was distributed over the face, neck, or ear. Of this number, twenty showed also an involvement of the auditory nerve. The distribution of the eruption in these cases was as follows:

Herpes occipito-collaris	32	cases.
Herpes auricularis	13	"
Herpes facialis	12	"
Herpes occipito-collaris and auricularis	3	"
Herpes facialis and occipito-collaris	1	case.

The herpetic inflammation of the geniculate presents the following clinical types:

1. Herpes auricularis.
2. Herpes auricularis, facialis, or occipito-collaris, with facial palsy.
3. Herpes auricularis, facialis, or occipito-collaris, with facial palsy and hypoacousis.
4. Herpes auricularis, facialis, or occipito-collaris, with facial palsy, deafness, and symptoms of Ménière's disease.

HERPES AURICULARIS, OR HERPES OTICUS.—This manifestation of herpes zoster has been recognized by all

systematic writers. It has, however, always been referred to the trigeminus nerve or ganglion, or to the cervical ganglia or nerves. Up to the time of the publication of my paper, the only recognized localization of an herpetic inflammation on a cranial nerve ganglion was the Gasserian. While there is no question that the eruption may involve the anterior and posterior portions of the auricle in cervical and facial herpes, there is a well-defined clinical type dependent upon a geniculate inflammation in which the eruption is distributed over the concha, external auditory canal, and the tympanic membrane. I would therefore restrict the use of the terms "herpes oticus" and "herpes auris" to this distribution.

As with herpes zoster in general, mild prodromal symptoms not infrequently precede the onset of the pain. In herpes auris, the preherpetic pains are referred to the depths of the ear, external auditory canal, and the auricle. These may reach an extreme degree of severity. In a few cases the tympanic membrane itself has been incised to relieve a supposed middle-ear inflammation. In severe cases not only are pains felt in the interior of the ear but they radiate also in the three branches of the fifth nerve, and to the mastoid, occipital, and cervical regions. In many cases the auricle becomes red and swollen, and quite tender, assuming an erysipelatous or frost-bitten appearance; the external auditory canal may be practically occluded by the swollen tissues, thereby inducing a mechanical interference with hearing which must not be confused with the deafness resulting from true lesions of the auditory nerve, which will be described later.

Usually on the third or fourth day the characteristic eruption makes its appearance, the abundance of the vesicles varying greatly in different cases. In rare instances the vesicles have been confined to the tympanic membrane, with all the other manifestations of true

herpes zoster.[1] In one of my own cases with facial palsy and hypoacousis, only two very small patches were present, one at the inferior border of the external meatus, the other beneath the anthelix.

From an analysis of thirteen cases of herpes oticus, I would confine the zoster zone to the tympanum, external auditory canal and meatus, the concha, tragus, and antitragus; also an adjacent marginal area which coincides with the tendency of these zones to overlap.

As bilateral herpes zoster of the Gasserian ganglion is occasionally observed, it would seem probable that the geniculate ganglia might also be the seat of a bilateral involvement. Such a case is recorded by Chavanne.[2]

The eruption follows the usual course of zoster, all trace, save a few pigmented scars, disappearing in the course of a fortnight. Post-herpetic otalgias in this group of cases are often very severe and persistent, especially in the old.

HERPES AURICULARIS, FACIALIS, OR OCCIPITO-COLLARIS WITH FACIAL PALSY.—In this group the inflammation has extended to the trunk of the facial nerve. Its confinement within a narrow bony canal may also by pressure play a rôle in the production of this symptom. The palsy may appear with the eruption, or it may be delayed a week or even longer. As its onset is often insidious, it is frequently overlooked, so that too much stress should not be laid upon the patient's statements as to the time of its appearance. As the occurrence of repeated crops of vesicles are not infrequent in zoster, it is possible that a succession of inflammatory changes may be taking place within the affected ganglion. This might in some cases explain the length of time intervening between the appearance of the eruption and the palsy. The palsy

[1] Szenes, "Herpes Zoster des Trommelfelles," *Internat. Centralbl. für Ohrenheilk.*, i., 1902.

[2] "Zona bilaterale, isole de l'oreille," *Annal. des mal. de l'oreille*, 1906, p. 639.

in all of the sixty-one cases was complete, involving all branches of the nerve.

A rather striking peculiarity is the not infrequent evanescence of this symptom, in some cases lasting only a few days, and many of them clearing up within a month. More severe types of the paralyses, however, occur with reactions of degeneration, and leaving permanent weakness and contractures. In a very large proportion of cases the sense of taste was affected on the anterior two-thirds of the tongue, which is readily explained by the involvement of the chorda-tympani nerve at the geniculate level.

As has already been remarked, facial palsies may occur with herpes occipito-collaris, and herpes facialis, as well as with herpes auricularis. This I would explain by the simultaneous occurrence of inflammatory changes in a series of ganglia.

HERPES AURICULARIS, FACIALIS, OR OCCIPITO–COLLARIS, WITH FACIAL PALSY AND HYPOACOUSIS.—In this group, in addition to the herpetic manifestations and the facial palsy, there is hypoacousis. The presence of auditory symptoms is to be explained by the extension of the products of inflammation to the acoustic nerve. If this is transitory and slight, it is the result of inflammatory œdema only; if more severe, the nerve trunk is probably directly invaded by the inflammatory process.

HERPES AURICULARIS, FACIALIS, OR OCCIPITO-COLLARIS, WITH FACIAL PALSY, DEAFNESS, AND SYMPTOMS OF MÉNIÈRE'S DISEASE.—This is the severest and most interesting manifestation of the disease. Here, in addition to the facial palsy and deafness, there are present the classical symptoms of Ménière's syndrome,—tinnitus aurium, disturbances of the equilibrium, nystagmus, vomiting, and labyrinthine vertigo. Of the twenty cases which presented symptoms of involvement of the auditory nerve, nine showed hypoacousis only. In the other eleven the symptoms of Ménière's disease were present.

The distribution of the eruption in these cases was as follows:

Herpes occipito-collaris	9	cases
Herpes auricularis	7	"
Herpes facialis	4	"

Before leaving this subject I would call attention to the occasional presence of auditory symptoms in cases of herpes about the face and neck in which facial palsy was absent. Gruber[1] noted in his cases of herpes auris that there were tinnitus and diminished hearing, and referred these to a probable reflex involvement of the auditory nerve. The same peculiarity was observed by Vail[2] in his case of herpes auris. As facial palsy in these cases is often very transient, it may possibly have been overlooked, for if, as I infer, the auditory symptoms are dependent upon an extension of the inflammation from the geniculate, one would hardly expect to find them present without facial palsy, as the inflammation must traverse the trunk of the seventh to reach that of the eighth.

I also find that in some cases of herpes facialis auditory symptoms were present without facial palsy (Cassé[3] and Burin-Desrozier[4]), so the thought naturally suggests itself that the ganglia of the acoustic nerve may also be brought within the realm of the specific infection of herpes. (See Fig. 2.)

It will be recalled in this relation that the ganglion acousticum is an outgrowth of the so-called neural ridge, from which the Gasserian, geniculate, and posterior spinal ganglia take their origin. In the course of development the cells of the geniculate ganglion assume the spinal unipolar type, whereas those of the acoustic

[1] "Herpes auricularis," *Monats. f. Ohrenheilk.*, 1875, No. 5.

[2] "Herpes zoster auris," *Jour. Laryngol. and Rhinol.*, 1907.

[3] "Zona de la troisième branche du trijumeau," *Thèse de Paris* 1901.

[4] "Zona de la deuxième branche du trijumeau," *Thèse de Paris*, 1904.

ganglia (ganglion of Corti, and ganglion of Scarpa) retain their primitive bipolar character. But the extreme severity and persistence of the acoustic symptoms in some of these cases, and the occurrence of acoustic symptoms without facial palsy, and the origin of these cells in the neural ridge, seem to me strong evidence that herpetic inflammation of the acoustic ganglia may occur in the cephalic forms of zona.

DIAGNOSIS.—The diagnosis of these cases is not difficult. The prodromal symptoms, the intense neuralgic character of the pain (pre- and post-herpetic neuralgia and otalgia), with the appearance of the characteristic eruption, should separate this from all other affections of the ear; and yet I believe that many of the cases are not recognized and properly classified. The area of the eruption is often so small, and the redness, swelling, and tenderness of the auricle so great, that many cases, I have no doubt, are regarded as diffuse inflammations of the auricle, perichondritis, frost-bite, and the like. In the later stages, with itching and scaling, the affection might be confused with eczema of the auricle.

That the condition is frequently overlooked would seem to be confirmed by hospital statistics. That the affection is not a common one is shown by Gruber's series, who found five cases in 20,000 cases of ear disease. To ascertain, if possible, some knowledge of the frequency of the affection in this country, I examined the annual reports of several of our large eye and ear hospitals, with the following result:

In the Manhattan Eye and Ear Hospital, during a period of ten years, with a total of 47,600 cases, the diagnosis of herpes auris was made in two instances.

In the Brooklyn Eye and Ear Hospital, during a period of five years, with a total of 15,000 cases, the diagnosis was made but once.

In the New York Eye and Ear Infirmary, one of the

largest institutions of its kind, during the past twenty years, this diagnosis was recorded only six times.

In the Massachusetts Eye and Ear Infirmary, however, during a period of ten years, with a total of 65,000 cases, the diagnosis was recorded thirty-three times.

In these reports it is not stated whether the zoster was primary or secondary, but the infrequency with which the diagnosis was made is worthy of note.

The recognition of those types of cases in which the facial nerve and acoustic complications are present should not give rise to difficulty, unless seen after the disappearance of the eruption; even then a retrospective diagnosis might be possible from the character and severity of the initial herpetic pains, and the presence of pigmented scars. I would particularly emphasize the importance of a careful examination of the tympanum, auditory canal, and the recesses of the auricle, as the small patches of vesicles may be concealed and overlooked. The facial palsy occurs with, or follows soon after, the eruption,—auditory symptoms, if present, manifesting themselves about the same time. It should also be borne in mind that symptomatic herpes zoster of the auricle may complicate otitis media and tumors in this region.

PROGNOSIS.—The prognosis in these cases is generally very favorable. The exceptions are the occasional persistence of tinnitus and deafness in the Ménière's type. Residual symptoms of facial palsy may also persist. Very rarely in old people, prolonged and intractable otalgias may continue for a considerable time.

It would seem advisable, as the symptoms are dependent upon hemorrhagic inflammations of the neural structures in the depths of the auditory canal, to leech the mastoid region in all cases as soon as the diagnosis is made, in the hope that this may prevent serious inflammatory invasion of the nerve trunks.

CONCLUDING REMARKS.—The syndrome which I have

outlined, depends for its characteristic features upon the relation of the geniculate ganglion to the seventh and eighth nerves, which are enclosed in a common sheath and course within a narrow bony canal. The syndrome is composed of three distinct groups of cases long recognized and the subject of much discussion. The clinical relation of these groups to one another and their common pathology has not been recognized. In the group with facial palsy, the paralysis was regarded as a rheumatic or toxic neuritis. The same interpretation was given to the group with auditory symptoms. Some idea of the confusion attending the classification of this latter group may be obtained from a perusal of the following list of titles: Polyneuritis cerebralis Ménièreformis (Frankl-Hochwart, 1899, and Berger, 1905); Ueber ein Fall von gleichseitigen, akut aufgetretene Erkrankung des Acusticus, Facialis und Trigeminus (Kaufmann, 1896); Zur Lehre von der peripherischen Facialis Lähmung (Hoffmann, 1899); Beitrag zur Casuistik der multiplen Hirnnerven Erkrankung (Hammerschlag, 1898); Herpes Zoster Oticus (Körner, 1904); Trouble auditive dans le zona (Lannois, 1904).

NOTE—For a full bibliography and discussion, see author's article "On Herpetic Inflammations of the Geniculate Ganglion," *Journal of Nervous and Mental Diseases*, February, 1907; also The *Transactions* of the American Neurological Association, 1906, page 184; and the "Transactions of the Meeting of the New York Neurological Society" held March, 1907, *Journal of Nervous and Mental Diseases*.

EXPLANATION OF TEXT-PLATE.

FIGURE 1. The geniculate ganglion (intumescentia ganglioformis); its relation to the facial and auditory nerves and its communications (Cunningham's Anatomy).

VII., Facial nerve.
P. I., Pars intermedia.
VIII., Auditory nerve.
Aq. Fal., Aqueduct of Fallopius.
G, G, Geniculate ganglion.

ILLUSTRATING DR. HUNT'S ARTICLE ON HERPETIC INFLAMMATIONS OF THE GENICULATE GANGLION.

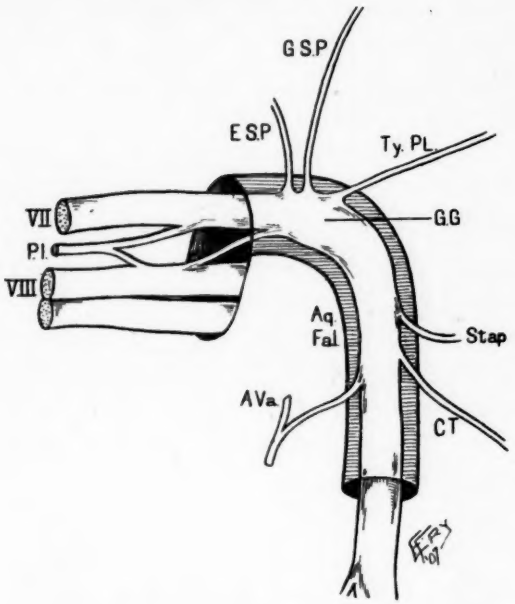

FIG. 1.—The relations of the geniculate ganglion.

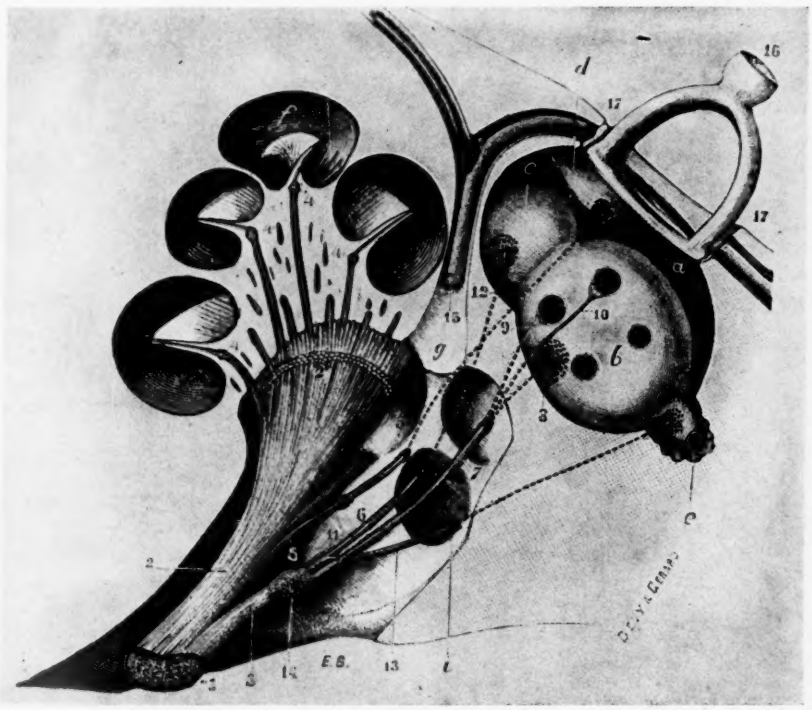

FIG. 2.—The terminations of the auditory nerve.

E. S. P., External superficial petrosal nerve.
G. S. P., Great superficial petrosal nerve.
Ty. Pl., Branch to the tympanic plexus.

FIGURE 2. The ganglia and terminations of the auditory nerve (Testut's Anatomy).

1. Auditory nerve.
2. Cochlear branch.
3. Vestibular branch.
4. Ganglion of Corti.
6. Ganglion of Boettcher.
14. Ganglion of Scarpa.
15. Facial nerve.

THE DEMONSTRATION OF DISTURBANCES OF EQUILIBRIUM IN ONE-SIDED DISEASE OF THE LABYRINTH.

By Dr. KROTOSCHINER, Breslau.

Abridged Translation from the German Edition, *Zeitschr. f. Ohrenheilk.*, Vol. LI., p. 395, 1906.

FOR the successful treatment of suppurations within the labyrinth it is of great importance to diagnosticate an infection of the internal ear before we proceed to operation. The involvement of the internal ear is evident in that class of cases which present typical labyrinth symptoms, irritative symptoms on the part of the vestibulo-semicircular canal apparatus (subjective vertigo, objective disturbance of equilibrium, nystagmus) and symptoms of defect on the part of the cochlea (marked deafness or total loss of hearing). There remains a series of cases in which nothing is found before operation to draw attention to a suppuration within the labyrinth, then, either during or after operation on the middle-ear cavities, frequently during an otherwise undisturbed convalescence, distinct signs of an infection of the labyrinth appear. Frequently a beginning meningitis is the first danger signal. After Jansen, Hinsberg has drawn attention to the danger of these so-called latent labyrinth suppurations, and many publications of the last years show how unfortunate it is to overlook the infection of the labyrinth.

The reason for this seems to be that after complete destruction of the labyrinth true irritative symptoms such

as vertigo, etc., are no longer produced, even if the disease extends. Symptoms of defect have not been recognized until recently; their existence seemed probable, for when an organ is destroyed, its function is lost. It was believed that the function of one destroyed semicircular apparatus could be completely taken over by the healthy apparatus of the other side. Von Stein's investigations have shown that this is not correct. We are to-day able with his methods to show in most cases if a one-sided destruction of the labyrinth has occurred. His publication has shown distinctly that in all cases which he has examined disturbances were present which must be regarded as symptoms of defect.

I had the opportunity of examining a number of cases from the Breslau Ear Clinic according to von Stein's method, where one-sided disease of the labyrinth was present. The results of this examination are briefly as follows:

I. COURSE OF EXAMINATION.

A. Hearing Tests.

As the affection in all of our cases was one-sided, we were able to base our examination on the experiences of Bezold for the determination of one-sided deafness. Edelmann's tuning-forks were used: C_2–C clamped, c–c^5 unclamped. In the usual manner the relation between the perception of each tuning-fork for the person examined and the normal perception duration was determined.

B. Static Examination on a Horizontal Plane.

We examined the patient standing on his two legs, on his toes, standing on one leg, right, then left. Each test is performed first with open then with closed eyes. It is necessary to note how long the patient can maintain the assumed position, whether he stands quietly

or sways and whether vertigo or other subjective disturbances occur.

C. Static Examination on an Inclined Plane.

For this purpose we employed von Stein's apparatus (goniometer). This apparatus is very easy to have made and is not at all expensive. To assure that the patient keeps the vertical position on the goniometer a rule is attached to the patient's back provided with two pendula. The patient is then placed on the apparatus and the movable board is slowly and uniformly raised. The four tests to be performed in this way are: inclinatio anterior, inclinatio posterior, inclinatio lateralis dextra, inclinatio lateralis sinistra. Kümmel has suggested the following terms: deviation back up, front up, healthy side up, affected side up. Each test is to be tried with open and with closed eyes. There are in all eight tests. It is necessary to observe at what angle of inclination the patient examined can remain in a vertical position with his feet close together and his knees touching. To obtain satisfactory results these experiments must be repeatedly made, as it requires some practice for a patient to stand on the goniometer. In normal persons von Stein found, notwithstanding whether the experiments were made with open or closed eyes, the following averages:

Inclinatio anterior	35°–40°
" posterior	26°–30°
" lateralis dextra	36°–38°
" " sinistra	

We also have examined a number of normal persons and can confirm these results, though we sometimes found with closed eyes a diminution of from 3–4.°

D. Active Centrifuging.

Active centrifuging is performed according to Wanner. The person examined must turn ten times to the right

about his own axis and then to the left, with open and with closed eyes. This makes four different experiments. In the normal person, according to Wanner, this results in moderate vertigo, moderate swaying, nystagmus most marked in the direction opposite to the rotation. Sometimes a less marked nystagmus occurs on directing the eyes in the rotation direction, and others present this symptom on looking straight ahead. It seems to make very little difference in this experiment whether the eyes are kept open or closed.

E. Passive Centrifuging.

This is performed by means of a rotating disk of about five feet in diameter. The following positions are selected: face to the centre, face to the periphery, forwards and backwards (this while the patient is sitting in a vertical position), horizontal decubitus. The rotation in each case was to the right and to the left with open and with closed eyes. The rapidity of the rotation was such that a complete revolution occurred in five seconds. There were usually five rotations. The normal person under these circumstances suffers from slight vertigo and nystagmus. When the face is directed to the centre the nystagmus is opposite to the rotation; with the face directed to the periphery, the nystagmus is in the direction of rotation; forwards, nystagmus to the centre; backwards, nystagmus to the periphery; horizontal decubitus, no nystagmus. If the centrifuge is suddenly arrested and the eyes are kept closed, there is a sensation of counter-rotation which persists for a few seconds. According to von Stein the normal person with open eyes does not perceive this counter-rotation.

F. Dynamic Examination (Walking and Jumping Tests).

We have carefully examined, according to von Stein's plan, thirty-one different forms of walking, each with

open and with closed eyes. Imprints were made after blackening the soles of the feet of the patient with a mixture of soot and petroleum. The patient was then directed to walk along a strip of paper. The imprints were in many cases very distinct. Von Stein has published a series of these ichnograms in the *Annales des mal. de l'oreille.* This examination is extremely tedious and also very trying for the patient. In order to get reliable results it has to be undertaken in two or three sessions. There are in all sixty-two varieties of gait, walking and jumping, forwards and backwards, on one foot and on the other, with the entire foot or with the toes, turning and jumping.

II. MATERIAL.

We have examined fourteen cases in this extensive manner. Six were patients who had been operated on in the labyrinth. The oval window was enlarged, the promontory partly removed, the lower turn of cochlea destroyed, and a counter opening made in the horizontal canal. We were able in these to assume complete destruction and loss of function in the labyrinth. Two cases were examined before operation. They presented under nomal conditions no manifest symptoms except that in the history it was stated that severe vertigo was complained of a long time before. At operation there was marked destruction in the labyrinth. In four cases there was a fistula in the horizontal semicircular canal without demonstrating any further destruction in the labyrinth. In two of these the operation had been performed several years ago. In the other two the patients were examined before operation. In Case XIII. the patient was a girl eight years of age, so that her statements are probably not reliable. At operation a cavity was found which extended to the apex of the pyramid, and we were not able to determine with certainty whether

the labyrinth had been opened. In Case XIV. consent to operation could not be obtained.

III. RESULTS OF EXAMINATION.

The detailed examination of these cases will be found on pages 401–413 of the article in the German edition.

IV. RESUMÉ OF THE RESULTS.

A. Hearing Tests.

In all cases where the labyrinth was destroyed at operation, deafness was present in the operated ear; also in two cases where the presence of extensive disease of the labyrinth was confirmed at operation, which had led to an opening of the labyrinth. In Cases IX. and XI. there was deafness, though at operation only a fistula in the semicircular canal was present. In Case XI. a sequestrum of the cochlea subsequently was discharged. Different is Case X., where a fistula was found in the semicircular canal, and now two years after operation distinct remnants of hearing are present. In Case XII. some hearing could be determined with certainty; a fistula in the semicircular canal was subsequently found at operation.

With Weber's test in cases of deafness the sound is usually transferred to the healthy ear, but not in all cases (IV.). Bone conduction is always abbreviated (Schwabach's test); Rinne's test is always negative on the affected side. Whisper is heard not at all or directly at the ear (IV.). In the cases in which the Lucae-Dennert test was made the results of our hearing tests were confirmed.

B. Static Test on Horizontal Plane.

All cases where the labyrinth is surely destroyed show changes. In Case XII. they were absent. In this case probably, as Hinsberg has shown, there was circumscribed disease in the semicircular canal. In Case XI.

(fistula in the semicircular canal, later cochlear sequestrum) they were absent before operation. They were most easily demonstrated when the patients were asked to stand on their toes with closed eyes as well as on standing on one leg with closed eyes, especially on the leg of the affected side, so that in three cases the experiment could not be performed. In one case the patient was able to stand only with legs spread apart. On approaching the feet the patient falls to one side, even if the eyes are open.

C. Goniometer.

In all cases where the labyrinth has been destroyed by operation there are distinct disturbances which vary in their intensity. In Case XII., where we assume the presence of circumscribed disease, the changes could not be found. The degree of inclination which is supported with the eyes closed is always distinctly less than when the eyes are open.

D. Active Centrifuging.

This could not be carried out in only one patient. In seven marked nystagmus occurred, not only on turning to the right but on turning to the left—that is, turning the eyes to the side opposite to the direction of rotation. In Case II. there was slight nystagmus also on looking in the same direction as the rotation and on looking straight ahead. In one case there was no nystagmus. In one other in turning to the left with closed eyes nystagmus appeared on looking to the right. In Case VII., slight nystagmus in all directions on turning to the right, while in Case VIII. there was moderate nystagmus in all turning of the eyes in every direction. Case XIII. showed moderate nystagmus on looking to the right after being rotated to the right or to the left with open eyes. In a number of cases vertigo set in, especially marked in

Case II., where, consequently, the examination with closed eyes could not be undertaken.

E. Passive Centrifuging.

Of our fourteen cases four could not be examined on the movable disk. Case I., because on the slightest rotation severe vertigo appeared which increased to a stage of nausea; in the other three cases time did not permit us to examine for this particular test. In the other ten cases the nystagmus appeared always in a normal manner. In one case only it seemed to be absent with closed eyes. Vertigo appeared in only three patients, in Case VII. in two tests with closed eyes. The sensation of counter-rotation was present in some cases on turning with the eyes open. In most cases, however, on turning with closed eyes this symptom is very briefly present or absent. It was distinct in two.

F. Dynamic Examination (Walking and Jumping Tests).

In all operative cases (I.–VI.) there were more or less marked disturbances in the walking tests. In five of the cases the tests were well performed with the eyes open; on the other hand, there was distinct disturbance as soon as the test was attempted with closed eyes. In five of the cases the disturbance was marked even while the eyes were open. On closing the eyes in two cases the disturbance was so marked that the rest of the experiment could not be attempted. In Case XIV. marked disturbance appeared with open or closed eyes. No disturbance was present in two cases where at operation a circumscribed disease was found. In Case XI. a sequestrum of the cochlea was subsequently discharged. In all cases where the labyrinth was destroyed at operation, as well as in cases where extensive disease of the labyrinth was confirmed by operation, no vertigo or any other subjective disturbance occurred during the most marked

disturbance of equilibrium. The only exception was Case VII., in which the test with closed eyes produced moderate vertigo. As in these cases vertigo sometimes appears spontaneously, we may assume that the end organs of the nerves had not been completely destroyed. In Case XIV. vertigo appeared with open and closed eyes.

V. COMPARISON OF OUR RESULTS WITH THOSE OF OTHER INVESTIGATORS, WITH CONCLUSIONS ON THE VALUE OF THE VARIOUS TESTS.

Extensive examinations of patients with only one labyrinth have been undertaken by Bezold, Stenger, Wanner, Kümmel, Passow, Noll, von Stein. A short report of these examinations and the ones which we undertook is given in the following.

A. Hearing Tests.

Jansen says that he usually has found, in diseases of the labyrinth on one side, deafness, occasionally hearing remnants (in fistulæ of the canals). These were, however, not exact investigations according to Bezold's method. Bezold always found, in extensive destruction of the labyrinth, deafness. He regards one-sided deafness as the most important symptom of a labyrinth suppuration. Passow found deafness on the side of the ear with the diseased labyrinth. So did Kümmel. Von Stein in one of his patients found hearing remnants, in all the others one-sided deafness. In our cases, as far as they concern patients without labyrinths, we found one-sided deafness. Hearing remnants were present in only one case where at operation a fistula in the semicircular canal was found, and in another case where at the operation subsequently undertaken a fistula was also found in the semicircular canal. In Case XIII. hearing remnants seemed present, but on account of the youth of the patient, the answers were not exact.

Conclusion: In complete destruction of one labyrinth

there is always deafness on that side. There are, however, a number of cases where, notwithstanding symptoms of irritation and defect on the part of the vestibulo-semicircular canal apparatus, and notwithstanding the presence of a fistula in the semicircular canal, more or less hearing has been shown to exist. We may therefore assume that one-sided deafness is an important symptom of labyrinth suppuration, though we should not depend upon the results of the hearing tests exclusively. It is always necessary to search for other labyrinth symptoms with which, together with deafness, a certain diagnosis can be made. From the absence of deafness it is not correct to deduce that a labyrinthine suppuration does not exist. There may be circumscribed disease in the semicircular canal.

B. Static Examination on a Horizontal Plane.

Notes on the standing of patients are to be found in most published cases of labyrinthine disease. Kümmel in his cases found a certain wavering on standing on the toes with closed eyes. The disturbance was more marked when standing on one leg, especially with closed eyes. This author believes that the patient generally is able to stand better on the leg of the sound side than on that of the diseased side. In von Stein's cases no difference was found between the two sides. Our results agree with those of Kümmel. We found in almost all of our cases more or less decided disturbance, so that it gave us some valuable information for the diagnosis.

C. Static Examination on an Oblique Plane (Goniometer).

Kümmel and von Stein also mention their results of examination with the oblique plane. The former, however, states that he could not come to any definite conclusion. Von Stein finds that in all of his cases the angle of inclination is diminished, compared to the normal, more pronouncedly when the eyes are open. He believes

that Kümmel did not arrive at any satisfactory conclusions because he did not pay enough attention to the vertical position of the patient during the test, as he did not make use of the rule which von Stein mentions.

Our cases were examined, according to the description of von Stein, with a rule, and in most of them there was a diminution of the figures. The examination with the goniometer seems to us, in many diseases of the labyrinth, to furnish valuable information.

D. Active Centrifuging.

In the conclusion of his exhaustive paper on nystagmus, Wanner presents the following two theses:

1. In the normal-hearing man the eyes move most when turned in a direction opposite to the rotation, while when directed in the same direction the movement is completely absent or is only very slight.
2. In those with a labyrinthine defect on one side the nystagmus is completely absent on rotation from the healthy to the diseased ear.

The correctness of the first thesis is, of course, self-evident, and we may even regard this form of nystagmus as physiologic. As regards the second thesis, Panse found in his Case III., on rotation towards the diseased ear, nystagmus. A similar condition was observed by Eschweiler and Noll and Passow in three cases. Kümmel mentions that his examinations coincide more or less with those of Wanner, although he observed in three of his cases physiologic nystagmus.

In our material of eight cases with labyrinth defective in function, and in one case where this defect was probably physiologic, nystagmus was present. In only two cases can the phenomenon coincide with Wanner's thesis. In these two cases nystagmus was absent on turning to the diseased ear, and in Case III. it was absent on turning to the healthy ear. In another case

the nystagmus was also absent on turning to the healthy ear when the eyes were kept open, but appeared directly they were closed. One case was very much like Noll's case; nystagmus appeared only on turning to the diseased ear. We see, therefore, that Wanner's thesis is incorrect, and no investigators have been able to confirm his experiences.

The presence or absence of vertigo does not furnish us with definite information. It may be present in one case while in another of exactly similar character it may be absent. That vertigo and nystagmus were absent in the case reported by Klug is not remarkable, as it occurred in a patient with a bilateral labyrinth defect, and this has been observed during the examination of deaf-mutes.

In view of these unsatisfactory results and the severe vertigo which is apt to occur, we think that it will be best in future to leave out this test.

E. Passive Centrifuging.

Though von Stein observed an absence of nystagmus in certain rotations in his cases, nystagmus occurred in all of ours in a normal manner. The cases of Passow and Noll cannot be compared, because passive rotation on a swing produces different conditions than on the rotating disk. Passow found, in one-sided labyrinth defect, nystagmus in a physiologic sense.

Vertigo is usually absent, though it may occur in some cases.

The presence or absence of the sensation of counter-rotation should be investigated. From what has been said, the appearance of this symptom should only be expected on rotation with closed eyes. We, however, found it present a number of times with the eyes open. With the eyes closed, in most of our cases, it appeared for a very brief period or was entirely absent. Von Stein's opinion, that an absence of this sensation of counter-

rotation when the eyes are closed suggests an affection of the labyrinth, seems to be correct. It is striking and difficult to explain why this symptom should appear uniformly in all directions of rotation, although only one labyrinth has lost its function.

The results obtained by this test are not in proportion to the time and trouble expended.

F. Dynamic Test (Walking and Jumping).

Most observers make only a very brief mention of this test, and the simplest experiments only have been tried. Stenger found in his cases, on walking towards a definite point, that there was a tendency to diverge towards the diseased side. Kümmel was not able to obtain any reliable results, though he mentions that jumping on one foot seems extremely difficult. Noll's patient did not show any characteristic symptoms when his gait was tested. The patients who have been thoroughly examined for their gait gave some very interesting observations. In Klug's cases, with twenty-two walking tests, there was a distinct deviation from the original direction. In von Stein's cases these tests also showed distinct abnormalities. Our cases where the labyrinth was defective on one side also presented distinct disturbances of gait. We can, therefore, confirm von Stein's deduction, that a suppuration in the labyrinth is always associated with disturbances of equilibrium during movements; these disturbances are most marked on jumping with closed eyes. In most cases the disturbances are unaccompanied by vertigo or other subjective symptoms. They can be explained by the defect of the function of one labyrinth.

These defect symptoms seem to be as important for the diagnosis of one-sided labyrinth destruction as the well-known irritative symptoms.

One must be careful not to make the diagnosis of a

suppuration in the labyrinth simply from the negative result of the functional examination. Similar conditions may be caused by labyrinth diseases of other nature. We saw these symptoms occur in traumatic lesions of the internal ear and in a hysterical girl. Von Stein has mentioned cases of this character where the symptoms followed a trauma.

In order to confirm the diagnosis of suppuration of the labyrinth we must be extremely careful to observe the condition of the labyrinth wall during the operation on the middle ear.

VI. PRACTICAL DEDUCTIONS.

The danger of a non-recognized suppuration in the labyrinth makes it desirable that there should be methods by which a nearly exact picture of the functional disturbances of the labyrinth can be obtained. A number of tests and methods of examination have been recommended for this purpose. These consist in: examination of the hearing, static examination on horizontal and oblique planes (goniometer), active and passive centrifuging, dynamic tests (walking and jumping). In our experience, it is impossible to apply all these tests in each case of suspected labyrinth suppuration, as they not only require a large amount of time, but are too trying for the patient. They are, moreover, not all necessary, because they are not all equally reliable.

Those which are the most reliable and which are applicable to most cases, and sufficient generally to make a diagnosis of one-sided disturbance of the labyrinth, are as follows:

1. Hearing Tests. If possible, the construction of a hearing relief. If an extensive hearing test cannot be made, it should be determined whether on the diseased side forks from a' down are not perceived (Bezold), and the Lucae-Dennert test should be applied. Most records

of labyrinth diseases which have been published do not satisfy these conditions, and it is not possible to determine with certainty whether one-sided deafness is present. (This examination lasts about half an hour.)

2. Static Examination on a Horizontal Plane. Two-leg position, toe position, standing on the right leg, standing on the left leg; bending the trunk forward, backward, right and left.

The static examination can be easily performed, and, though the results are not always definite, they are of advantage.

3. Dynamic Examination (Walking and Jumping). The preceding observations have shown that disturbances of equilibrium are usually most evident on jumping backward with closed eyes. It is, therefore, proper that we should begin with this test. If this test is passed without showing any disturbance, extensive disease of the labyrinth is improbable. It is in most cases desirable to try the various tests of von Stein at least with closed eyes, because they usually furnish some information on the degree of disturbance. All of the sixty-two tests require about an hour, the more important ones about half an hour. On the graphic notation of the imprints the duration of the test is increased to three hours.

4. Examination with the goniometer gives us such remarkable results that it should be performed when possible, although we cannot as yet say that it gives us definite information for diagnosis.

5. Centrifuging has thus far not given us any definite results, and this test can be discarded for practical purposes. To advance our knowledge of the labyrinth function, however, the tests should be tried when it is possible to make use of them.

We have recently obtained the "plegometer" of von Stein; we have not been able to obtain any practical results, and shall report on this test at some future time.

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HYPERTROPHIC NASAL CATARRH AND COMPLICATIONS, WITH CLINICAL ILLUSTRATIONS.[1]

By CHARLES AUBREY BUCKLIN, M.A., M.D., New York.

HAVING operated on 31,181 cases since my invention of the nasal saw in 1880, I feel entitled to express my opinions upon this subject.

Hypertrophic nasal catarrh is occasioned by obstructions to nasal inspirations.

The vacuum formed within the entire respiratory tract with each forcible nasal inspiration amounts in the case of patients suffering from this disease to about one and thirty-six-hundredths pounds to the square inch.

With this vacuum reduced to about one half, the symptoms of catarrhal diseases and their complications frequently cease to exist within ten days. It has been demonstrated that with one half of these obstructions to nasal inspiration removed the amount of oxygen inspired has always been doubled.

It has been shown that the atmospheric relations between external and internal pressures have been changed to those that would have been experienced by changing the patient's residence to an altitude of about three miles above his present residence.

The atmospheric relations which exist before and after treatment can easily be demonstrated and com-

[1] Read upon invitation of the Massachusetts Medical Society, Berkshire District.

pared. This experiment always makes a favorable showing for this method of treatment.

The above conclusions can all be clearly demonstrated by experimenting with the "Respirometer" and "Displacement Vessels." The "Respirometer" consists of a glass tube four feet in length and three-eighths of an inch in diameter with a bore of about one-eighth of an inch in diameter. An opening is formed through this tube at one inch from the lower end, one-eighth of an inch in diameter, at right angles to the bore of the tube. This opening is for the purpose of admitting water freely in all positions of the tube. A rubber band is placed around the tube at the height to which water would rise in the tube when it is immersed in a glass of water. Another band is fitted with its lower edge thirty inches above the first band. When the tube is in use one must quickly notice the point above or below the lower edge of the second band to which water is raised and measure the distance.

A third band of rubber is placed on this tube, the upper margin of which is three inches from the upper end of the tube. These upper three inches of this tube are placed in the mouth of the patient who is being examined.

A clean glass of water is used in which the lower end of this tube is kept immersed when an examination is to be made. With the above conditions complied with, we are ready to answer the above indicated questions when the patient has taken a long, rapid, and forcible inspiration through the nose while the tube is held air-tight in the mouth.

The measurement of the height to which water is raised in the tube will enable one to conclude how great a vacuum the patient forms in the respiratory tract with each forcible inspiration.

The differences between the openings in the nostrils can be readily estimated by closing one of them with the finger during a full nasal inspiration.

The narrower nostril will cause water to rise higher in the

tube. The water will be raised higher in the tube when the inspiration is done through nostrils that have been pathologically obstructed. When the obstruction is from adenoids, the water will be raised higher than would be the case after they have been removed. There will not be any decided difference in the height to which water is raised in the tube by obstructing one nostril with the finger. In obstructions of this kind when a difference is noticed to exist it must be sought for in the pathological condition of the nostril. With a large number of persons who were afflicted with hypertrophic catarrh not complicated with pulmonary tuberculosis upon whom I have experimented as to the height to which they could raise water in this tube, it has been raised to thirty-six inches or more. In persons afflicted with pulmonary tuberculosis I have found only eight per cent. who did not require this operation for the cure of the catarrhal element of their diseases.

To make the physics plain regarding the changing of the differential atmospheric relations, consider every patient examined as a suction pump. To whatever height a patient can raise water in the "Respirometer," if you place this individual under a glass receiver and reduce the atmospheric pressure to one half with an air pump at the sea level, the pressure will be seven and one-half pounds, which experience has taught is equal to the pressure at an elevation of three miles. The patient with this reduction of pressure to one-half will be able to raise water during a deep nasal inspiration only to one-half the height he formerly raised the water in this instrument.

It makes no difference whether the patient's ability to raise water in the "Respirometer" is influenced by rare air or by larger openings through the nostrils. The differences between the atmospheric pressures have been largely compensated for, and this one element will greatly improve his catarrhal disease whether he be afflicted with

pulmonary tuberculosis or any of the numerous catarrhal complications.

If a person afflicted with pulmonary tuberculosis be so weakened by his disease that he can raise the water only six inches in the "Respirometer," and he has visible obstructions in his nose, the removal of a turbinated bone will so reduce his ability to raise water that he can raise it only three inches, which is the same improvement as in the case of the patient who could have raised the water to thirty-six inches and who had his ability reduced to raising it eighteen inches. The equalization of the internal and external pressures is in every case the same factor for which we are striving. One-half of the number of inches to which a patient can raise water in the "Respirometer" is used as a divisor to divide 15,840 feet, or three miles reduced to feet, for the purpose of showing for each patient the number of feet of elevation which corresponds to every inch by which the level of water he can raise in this instrument has been lowered.

I find reduction by this method of the relations between external and internal pressures more beneficial for the treatment of pulmonary tuberculosis or catarrhal diseases of the respiratory tract than the same reduction would have been as a result of a residence at a higher altitude. The elevation of tubercular patients to a decidedly higher altitude causes them to develop unpleasant pulmonary symptoms.

Not more than four attempts should be made to raise water in the "Respirometer" at any given trial, as the patient becomes fatigued. A time should be selected for this experiment when the patient is not tired. The complications of hypertrophic nasal catarrh are chronic catarrhal diseases of the entire respiratory tract and the accessory sinuses, obstructed nostrils, asthma, hay fever, catarrhal otitis media, chronic lachrymal disease, and pulmonary tuberculosis.

Pulmonary tuberculosis is placed as a complication

because it is exceptional for tubercle bacilli to infect lungs that are not affected with chronic catarrhal diseases. It can happen, and I know from experiments made in the Pathological Institute at Munich while I was a student there in 1877. This was before the tubercle bacilli had been discovered. Several animals that did not have chronic bronchial catarrh were infected by Prof. Bull and died during this year of pulmonary tuberculosis.

Physicians will generally support me in the following statements. While it is usual for persons to be affected with chronic catarrh this is not a necessary condition for their infection with tubercle bacilli. The infection having taken place, their lungs are immediately attacked with chronic bronchial catarrh, by means of which the patient's life is usually brought to an end. It therefore becomes an important disease to cure in these patients. Pulmonary tuberculosis can usually be cured in about nine months, with a less number of complications, after this operation has been performed for the removal of nasal obstructions. This is accomplished by increasing the diet gradually of the female to four quarts of milk daily and the male to a diet of five quarts of milk daily.

One-half to one ounce of fresh castor or olive oil is given in hot black coffee or in any other desirable way before retiring every night. The oil is necessary to clear out the alimentary canal so that this increased diet may be continued.

Either the above increase in diet or an equivalent increase must be made, or this disease will not be cured.

The cure of asthma, hay fever, catarrhal otitis media, and chronic bronchitis can usually be produced in three months. "Catarrhal otitis media" can usually be cured up to the twentieth year of the patient's life; the hearing is greatly improved up to the thirtieth year; after this date the prognosis is bad. With proper conduction the cure can, however, be promised at any period of life. No additional treatment is necessary after the operation

excepting inflation according to the "Valsalva method" —which consists in holding the nose air-tight with the fingers, taking a long inspiration, closing the mouth, and blowing as hard as possible until the ears are felt by the patient to expand.

DISINFECTION OF THE "RESPIROMETER."

This is accomplished by allowing the glass tube always to stand immersed in a solution of corrosive sublimate of 1 to 250. This solution is held in a galvanized iron pipe, four feet in length and three quarters of an inch in diameter. The two ends of this pipe are closed by caps containing soft-rubber plugs, one end having the cap so loosely fitted that it can be adjusted with the fingers. Thus closed, the tube holds the solution securely during transportation. The glass tube is always used wet. This prevents the salts of mercury from depositing a dirty-looking coating upon it. It presents to tubercle bacilli an instrument covered with a strong disinfecting solution upon which, should they fall, they will be destroyed.

There is certainly no chance of any one becoming infected with pulmonary tuberculosis through the use of this instrument. I have tried mercury in the place of water, and on account of the discouraging prospect of infection I have abandoned it. The displacement vessels also offer some additional elements of proof to the above statements. They consist of two graduated vessels holding one gallon each. The openings of both are stopped with large rubber corks, through each of which is conducted in an air-tight manner one arm of a U-shaped piece of galvanized iron pipe with an opening of three quarters of an inch, which is carried down to one quarter of an inch of the bottom of one vessel and in the other to the lowest point possible at which it will not act as a syphon. Another short tube is passed through

each cork air-tightly. This tube in the cork containing the longer arm is connected with a piece of rubber tubing eighteen inches in length. This vessel is filled with water. Patients are requested by a quick nasal inspiration to fill their lungs and then to blow on the rubber tube as long as they can. This will enable the average individual to displace about forty-eight ounces of water, which is measured by the graduations as it is displaced.

Remove the nasal deformities and the most prominent lower turbinated bone from the nostrils, and the same patient will displace ninety-six ounces of water. This is about the capacity of the average lungs. One can readily demonstrate with this apparatus that the ability to inhale oxygen has been doubled by these nasal operations. The entire amount of air which can be inspired with each inspiration can be determined. This is of value in making a final prognosis.

Neither of these instruments is necessary to the practitioner. They are necessary, however, for the development of the theory which led to the invention and support of these nasal operations. They are also necessary if any one desires to show the altitude to which the operation has changed the atmospheric relations of the patient operated upon.

TREATMENT.

Before attempting to operate in the nose, the parts should be thoroughly brought under the influence of a solution of cocaine, twenty per cent., ounce one, combined with a solution of adrenalin 1 to 1000, drachm one. This will make the operation painless and bloodless, and will enable one to operate under a general anæsthetic when necessary. If cocaine is used for a local anæsthetic, it must not be forgotten that the anæsthetic properties of this drug can be entirely destroyed by boiling twice. There are other local anæsthetics that are not destroyed

by boiling. The local anæsthetic used is best applied with a ladies' hat-pin, the point of which has been slightly roughened with a file. Absorbent cotton can be wound about this loosely for one inch and is immersed into the local anæsthetic used. Then two long immersed cotton plugs are pressed into the nostril, one on each side of the turbinated bone which is to be removed. The hat pin is twisted in the reverse way from which it is wound, and these pieces of cotton are allowed to remain in position for fifteen minutes, when the anæsthesia will be complete. These pieces of cotton are displaced by a sharp right-angled hook; the length of the hooked portion is about one sixteenth of an inch. The hook is passed flatwise to one side of these pieces of cotton, then the entire instrument is rotated and the hook engages the cotton, which is withdrawn.

These desired results are accomplished by removing all of the nasal deformities, with an additional proper removal of the most prominent lower turbinated bone which has been misplaced or diseased. The posterior extremity of the turbinated bone should always be removed. The judgment of the operator must decide how much of the anterior end of the turbinated bone requires removal for the relief of the nasal obstruction.

The teeth of the saw should be placed under and to the outside of the turbinated bone. These teeth should point upward and inward at an angle of 45° from the vertical. In this direction the bone should be sawed through.

These operations will cause the general health of the average patients having pulmonary tuberculosis to improve sufficiently to produce for them a gain of ten pounds during the first four days.

The proper removal of the most prominent lower turbinated bone is never omitted when it is necessary to reduce the water raised in the "Respirometer" to one

half the distance it was raised before the treatment was commenced.

Since 1880 the patients who have been treated by these operations have all been ambulatory patients.

Francke H. Bosworth in 1886 read a paper before the New York Academy of Medicine in which he acknowledged that priority belonged to me for having used the nasal saw first. The report of this paper may be seen with his signature in the New York *Medical Record* of January 29, 1887.

The saw referred to was a jeweller's saw number ten, covered at the outer end with solder so that it would not scratch. The necessary stiffness was supplied by enclosing it in a sheet of German silver. Only two and one half inches of the saw teeth were left free to cut. It was clamped in a pin vice so that it would cut upon withdrawal only. After having experimented since 1880 with every saw that has appeared I am obliged to return to the original principle involved in my first saw, which cuts upon withdrawal only. My saw of to-day is three inches long with twenty teeth to the inch, which are so set that they cut upon withdrawal only. The saw used by the butcher is the model for forming the teeth.

In the winter of 1906 I removed a turbinated bone from a man of fifty years of age at a hospital in Berlin in exactly five seconds.

The bone may conveniently be seized by stout artery forceps and easily removed, although slightly adherent after the operation. Hanging mucous membrane left after the operation should be removed by scissors immediately. The complication which usually follows the removal of a turbinated bone is secondary hemorrhage. This is overcome by dismissing every patient operated upon with a stout nasal spray and one ounce of a solution of adrenalin 1 to 10,000 strong, with which he is instructed to spray the nostril thoroughly should he experience any hemorrhage.

The only confirmation that I have of the above ideas is my large personal experience, taken with an article by E. H. Griffin published in the New York *Medical Record* on April 14, 1906, under the title "Turbinectomy." The author has operated ten thousand times. He states: "If I were to summon up from all the various operations that are resorted to in order to correct nasal obstruction the one that will give most permanent relief, I would without hesitancy name partial turbinectomy."

There has not been an unsatisfactory result from any of his operations. He has seen patients gain from ten to eighty pounds within six months after the operation. The cures of asthma, hay fever, and a case of catarrhal otitis which had deprived the patient of his hearing for years were effected so that the patient could hear his watch at two feet. These are among the cases reported by him which offer satisfactory confirmation of the ideas which I offer in this paper.

I have selected from my large clinical experience cases which illustrate every special claim in this essay, which I herewith publish:

CLINICAL ILLUSTRATIONS.

Case No. 1., M.P., age 27 years. He has had the disease three years and has consulted several specialists regarding it, without any beneficial results. He consulted me August 4, 1903. Weight 113 pounds. He raised water in the "Respirometer" to thirty inches. I removed the turbinated bone from the right nostril, after which he could not raise the water to more than twelve inches. This changed his differential atmospheric relations to an elevation of three and six tenths miles. He showed tubercle bacilli in his sputum.

His cough almost ceased within two weeks. He has followed his trade, supporting a wife and three children. His weight has increased to 149 pounds, making a gain of thirty-six pounds. This patient could displace double the quantity of water from the displacement vessel after the operation.

On June 1, 1904, the tubercle bacilli had disappeared. There is no cavity in his lungs and there is every evidence that he has been cured of pulmonary tuberculosis. This case demonstrates the fact that cases of this disease without any cavities in their lungs lose their tubercle bacilli in nine months or thereabouts, provided that their appetites are good.

Case No. 2. W. M., age 44; disease acquired fifteen years ago. Has had twenty-five hemorrhages. Applied November 6, 1902, for relief from a distressing cough and laborious breathing. He had a large cavity in his right lung, with infiltration throughout his left lung. He appeared very much like a dying man. In the left nostril he had ample breathing room. In the right nostril the lower turbinated bone was swollen and passed nearly through the middle of the nostril.

I tried him with the "Respirometer" and he raised water to thirty inches. He accepted my proposition to remove the lower turbinated bone from the right nostril. After the removal he could not raise water in the "Respirometer" to more than three inches. This showed an alteration in his differential atmospheric relations equal to the change he would have experienced had he changed his altitude to an elevation of five and four-tenths of a mile.

His bronchitis ceased annoying him after one week. On March 24th he had gained twenty-two pounds. The first examination of sputum showed tubercle bacilli. The next five examinations failed to show their existence. The seventh examination, made in October, 1903, showed them to be present again.

This patient could displace double the quantity of water from the displacement vessel after the operation.

He has been able to follow his usual vocation, which is that of a builder. He considers himself cured of pulmonary tuberculosis. Occasional tubercle bacilli are still found, which is the only reason why I cannot pronounce his disease cured.

If his appetite were good and he could have taken the same amount of nourishment as Case No. 1 took, I believe, as the result of my experience, that, notwithstanding the compli-

cations which are present, he would also have recovered entirely in nine months from his pulmonary tuberculosis.

These two cases of pulmonary tuberculosis, one taken from my successful list and one taken from my unsuccessful list, complete my illustrations regarding the cure of this disease.

Case No. 3. Mrs. S., age 24 years. Had a chronic bronchitis and catarrhal laryngitis from which she had suffered for two years. She had consulted many physicians regarding her disease, without any relief. Weight was 150 pounds. She did not show tubercle bacilli. She was constantly acquiring additional attacks of bronchitis complicated with cough and hoarseness. She thought that she had pulmonary tuberculosis. I removed the most prominent lower turbinated bone. She could immediately displace double the quantity of water from the displacement vessel. The cure was complete within two weeks. She can now ride on an open car without developing laryngitis or bronchitis, which she could not have done before this operation.

Case No. 4. G. W. P. He has suffered from hypertrophic nasal catarrh for four years. He has consulted specialists all over the country, without any benefit. He was frequently advised against submitting to any operation. He has never found in winter a temperature that is exactly suited to him. The air appears to have pepper slightly distributed through it. He could not tolerate artificial heat in a room. The discharge from his nostrils was profuse and annoying. Catarrhal deafness was a complication which developed in his left ear, which reduced his hearing 50 per cent. in this ear. I removed on September 25, 1904, the lower turbinated bone from his right nostril. In one week every annoying symptom had disappeared. He displaced double the quantity of water from the displacement vessel after the operation.

Case No. 5. Miss F., age 14 years. She had attacks of suppurative disease in the right middle ear for years. Has catarrhal disease in the left middle ear. Right ear heard a watch at one inch. Left ear heard a watch at three inches. These measurements were made after inflation. The defects in her nasal passages and naso-pharynx which caused the deafness were a deformity of the septum and a

misplaced lower turbinated bone in the right nostril, with the naso-pharynx filled with adenoids.

She had consulted specialists in New York, who had tried to relieve her nasal obstructions by repeatedly using electric cautery and caustics. The entire surface of the turbinated bone and the adjacent surface of the septal deformity were left denuded of their mucous membranes as a result of these operations. They were consequently firmly adherent in the right nostril. The deformity of the septum was removed by the saw, which left it attached to the turbinated bone. The saw was next introduced under and to the outside of the turbinated bone, which was bisected, at an angle from the vertical inward of 45°. This obstruction when removed from the nostril consisted of the septal deformity firmly attached to the turbinated bone. The adenoids were all removed. The hearing, without any other treatment, within one month was found to be as follows:

Right ear heard watch at twenty-five inches. Left ear heard watch at forty inches. She has never had any further trouble with her ear. This case was treated in 1890.

Case No. 6. J. McC., age 30 years; catarrhal deafness, which had been developing for ten years. He had consulted the most prominent specialists in New York and received from every one of them a hopeless prognosis. He could only hear my conversation through a rubber speaking-tube. In September, 1901, the deformed turbinated bone was removed from his nostril. He could displace double the quantity of water in the displacement vessel after this operation.

He says he commenced to improve within one month. I saw him at the end of three months and he had no difficulty in carrying on an ordinary conversation with me. He is decidedly fleshier.

Case No. 7. J. McW. He had suppurative lachrymal disease. I removed a hypertrophied lower turbinated bone for the cure of this disease. The result was a perfect success. The patient immediately after this operation was incredulous of this method of treating an eye disease and he consequently consulted Prof. H. Knapp about this operation. He was told that the method of treating this disease was originated by

Bucklin. He was, however, pleased to see an eye disease that had been so perfectly cured by a means he had never known about.

All claims made in this essay regarding the means of curing diseases by removing the obstructions to nasal inspirations have been especially illustrated. The cases have been fairly selected from a large number of cases which have passed under my observation.

I believe mine is the most reasonable method to employ in relieving hypertrophic catarrh, even if the case be complicated with an infection of tubercle bacilli.

A rapid introduction of this method of treatment depends upon the assistance of the medical profession.

Should any physician desire to observe the practical benefits which can be produced in any of these complications by these operations he should call on the author of this paper for proofs.

The details of the operations will be cheerfully shown and their beneficial results will be demonstrated.

REPORT OF A CASE OF DIPHTHERIA, COMPLICATED BY ACUTE PURULENT OTITIS MEDIA, MASTOIDITIS, AND INFECTIVE SINUS THROMBOSIS.[1]

By PHILIP D. KERRISON, M.D., New York.

(*With temperature chart in the text.*)

Kate Shelban, nineteen years of age, and a native of Poland, was admitted to the Willard Parker Hospital on January 12th, suffering from diphtheria. The high temperature on admission, *i. e.*, 104.8°, led to a thorough physical examination. The heart and lungs were normal. There was no rash. The ears were normal. Examination of the throat revealed enlargement and congestion of both tonsils, with slight membranous exudate confined to the right tonsil.

During the three days following her admission, the temperature described wide variations between 98° and 103°, reaching and remaining normal during the fourth and fifth days. On the sixth day, January 18th, the right drum-membrane was seen to be red and bulging, and was incised by the resident physician under chloroform anæsthesia. There was at this time no mastoid tenderness. On January 21st, the temperature rose to 102.4°, and distinct mastoid tenderness developed. On January 24th, physical signs of acute mastoiditis were unmistakably present. Examination of the blood revealed a leucocyte count of 15,000,—a differential count unfortunately not having been made. Mastoidectomy was performed under chloroform anæsthesia.

[1] Read before the Otological Section of the N. Y. Academy of Medicine, April 12, 1907.

The antrum and mastoid cells contained pus and granulation tissue. Pus taken from the antrum was found to contain only the staphylococcus albus. The tip and zygomatic cells were removed and the operation completed after the usual method. Owing to the rather suspicious temperature curve, the vertical limb of the sigmoid sinus was exposed over about ⅝ of an inch. The sinus wall was perfectly normal in appearance. During the week following the operation the temperature gradually returned to the normal, and the patient's condition seemed improved.

On February 1st, eight days after the operation, there was a rather abrupt rise of temperature from 99° at mid-day to 105° at 8 P.M.

On the following day the temperature was still 105°. Examination of the wound revealed a considerable pocket of pus below the mastoid wound, which it was thought might account for the temperature. This was freely opened under chloroform anæsthesia, fully a drachm of pus being evacuated. During the four days following this procedure, the temperature continued to suggest septic absorption, and the patient became progressively more septic in appearance.

On February 4th, the leucocyte count had fallen to 12,000, with polymorpho-nuclearphiles count showing 64 %. The eyes were examined by Dr. Wootton and found normal.

On February 5th, it was decided to explore the interior of the sinus. The sinus was therefore farther exposed upward and backward slightly beyond the knee, and downward in the direction of the bulb. On opening the vessel free hemorrhage occurred from the torcular end, but none from below. A curette introduced downward and inward into the horizontal limb dislodged a well organized clot about one-third of an inch long. Only moderate hemorrhage followed its removal. Preparations for removing the jugular vein were stopped by the anæsthetist who thought that the pulse indicated cardiac failure.

Two days later—*i. e.*, on February 7th, the patient being evidently more septic, she was again placed under the influence of an anæsthetic, and the jugular vein removed from a point a little above the clavicle to a point above the entrance of the facial vein. Following this operation the

temperature gradually fell to normal and remained so, recovery being slow but uneventful.

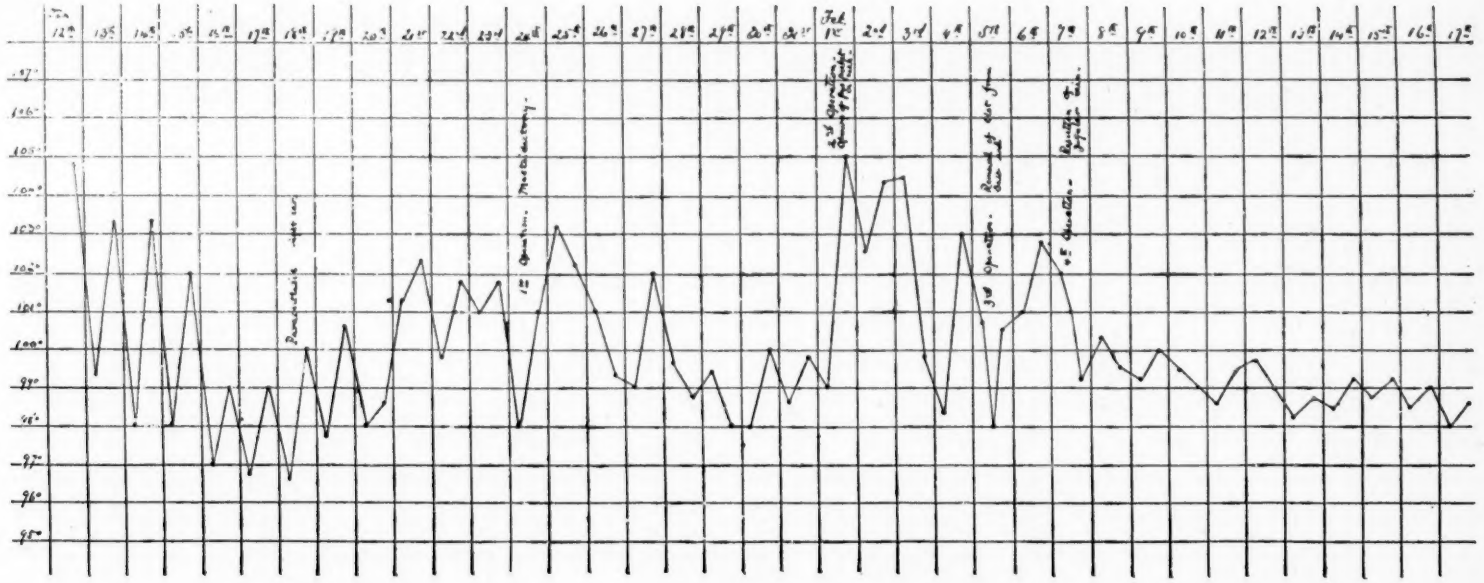
From the character of the temperature curve and the appearance of the patient at the time of the first operation, the writer is inclined to believe that the formation of the clot in or near the bulb occurred in this case as a very early phenomenon,—possibly as early as the time of the first operation.

A point not covered in the literature dealing with the management of these cases is the means by which we may determine the presence of a parietal or non-obliterating clot in the bulb or inner end of the horizontal limb of the sigmoid sinus in cases of suspected sinus thrombosis. The writer is under the impression that there is in reality no safe and practical means of determining the presence of such a clot even at the time of operation. This difficulty suggests two questions, viz:

1. In cases of suspected sinus thrombosis, in which no urgent need of immediate intervention is apparent, may not a reasonable delay in operating be advisable for the purpose of allowing a beginning clot to reach a stage of development more certainly demonstrable?

2. In cases in which septic absorption is in progress, and in which every reasonable care has been observed to exclude sources of infection outside of the sinus or bulb, may it not be wise, even though no demonstrable clot is revealed on opening the sinus, to resect the jugular vein, thus eliminating more positively this avenue of infection?

N. B.—The accompanying temperature chart gives simply the highest and lowest temperatures recorded each day.



Temperature Chart to accompany Dr. Kerrison's Report of a Case of Diphtheria with Otitic Complications.

OTITIC MENINGITIS.[1]

By Dr. ARNOLD KNAPP, New York.

Statistics: Recent statistics[2] have shown that uncomplicated otitic meningitis occurs as often after acute as after chronic purulent otitis.

In twenty-nine out of fifty-two cases, meningitis followed disease of bone, extending to the dura, which was involved to a varying extent. The diseased bone was situated in eleven at the tegmen of the antrum and tympanum; in sixteen, at the posterior surface, the superior edge, or the apex of the petrous pyramid; in twenty-two the infection extended through the labyrinth, generally along the internal auditory meatus. In a few the path of extension could not be determined.

These figures show that the meninges are first infected, in nearly three-fourths of the cases, in the posterior cranial fossa, and in slightly over one-fourth of the cases in the middle cranial fossa. A proper appreciation of this localization of the beginning meningeal infection is important in considering the possibility of operative treatment.

Forms of Meningitis: In certain cases where the infective process stops short of traversing the dura or remains in the labyrinth, symptoms of meningitis supervene, characterized by an increase of cerebro-spinal fluid

[1] Read at conjoined meeting of Sections on Otology and Rhinology of the N. Y. Acad. of Med., May 29, 1907.

[2] Heine: *A. f. O.*, vol. 50, p. 272, 1900.

and consequent increase of intracranial pressure. Lumbar puncture reveals clear sterile fluid under pressure. Removal of the primary focus in the temporal bone and release of the accumulated fluid are rapidly followed by recovery. This variety is termed serous meningitis or, according to Koerner, serous meningo-encephalitis. Pathologically it is explained as collateral œdema of the subarachnoid space in the proximity of a purulent focus.

If the infective process succeeds in perforating the dura according to the variety or rapidity of infection, the meningeal membranes may become agglutinated; an encapsulated intrameningeal abscess is formed. There may be superficial involvement of the brain substance or a brain abscess. Some of the symptoms of meningitis are present. The puncture fluid is clear or moderately clouded and may contain bacteria. If the walling-off of the intrameningeal process is incomplete, leakage takes place; the infection disseminates and the meningitis becomes general.

Finally there is the condition where no encapsulation of the infective process occurs, the infection rapidly extends throughout the entire arachnoid cavity, and general purulent meningitis is present. Lumbar puncture evacuates a distinctly purulent, bacterial fluid.

The classification of purulent meningitis into encapsulated, acute progressive, and general, is the one suggested by Heine.[1]

It is adapted from the classification of peritonitis of the general surgeons. The labyrinth is frequently an intermediary in the progress of the infection of the meninges. The anatomical conditions at the internal auditory meatus are not favorable for the encapsulation of the purulent process in the meninges, and general meningitis most frequently results.

Symptoms: As for the symptoms of meningitis, no

[1] Heine: *D. m. W.*, 1906, No. 4.

single symptom is characteristic. The diagnosis is frequently very difficult unless a number of symptoms simultaneously appear. Kernig's sign is perhaps the most constant. Schwartze, many years ago, stated that the diagnosis could not be definitely made until marked sensory disturbance, with clonic and tonic spasms of the extremities, was present.

Lumbar puncture is unquestionably a great aid in diagnosis. The degree of purulency of the fluid and the kind of bacteria present furnish valuable information on the existing variety of meningitis and the character of the infection. The findings are, however, not infallible. Thus Brieger[1] reported a case of brain abscess with fistula into the ventricles but without purulent meningitis where the spinal fluid contained bacteria, and Voss[2] found a similar state of the spinal fluid in a case of sinus thrombosis.

As many cases of meningeal infection begin in the posterior cranial fossa, rigidity of neck and symptoms of spinal meningitis, pain in the back and rectum, painful defecation, incontinence of urine and fæces, are first observed.

Prognosis: The prognosis of purulent meningitis is unfavorable, in fact until the last few years the outcome was regarded as absolutely fatal. Then cases were reported where purulent meningitis was cured by eliminating the primary focus and by repeated lumbar puncture. Macewen, Jansen, and Lucae have all reported cases of otitic meningitis successfully operated upon where circumscribed purulent collections within the dura were drained. Hinsberg[3] has been able to add seven cures and five cases of marked though only temporary improvement after drainage of the subarachnoid cavity.

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[1] Quoted by Heine, *Operationen am Ohr*, 2d ed., Karger, Berlin, 1906.

[2] *l. c.*, Heine, p. 186.

[3] Hinsberg, "Operative Treatment of Meningitis." These ARCHIVES, vol. xxxv., No. 5.

A remarkable case was that of Kuemmel,[1] a general surgeon in Hamburg, of which the following is a brief synopsis:

After an injury to the back of the head, the patient, a man thirty-three years old, was unconscious for two days and cerebro-spinal fluid escaped from the nose. He then complained of headache, vertigo, tinnitus, and deafness in the right ear; he became stuporous, with rigid neck, strabismus, and temperature of 102.6°. Lumbar puncture evacuated thick purulent fluid. The patient appeared to be moribund, and without anæsthesia two trephine openings, each as large as a silver dollar, were made on both sides of the occipital bone near the junction with the parietal bones. The dura was excised in this area; the arachnoid appeared cloudy and congested; a moderate quantity of purulent fluid escaped. Gauze tampons were introduced in both openings. The patient's condition improved from the next day and all the symptoms disappeared in six weeks.

Held and Kopetzky[2] recently reported a successful operation for otitic meningitis.

The patient, a child three years old, was operated upon for chronic purulent otitis. The tegmen over antrum and aditus was absent, and the dura in this area was covered with dark granulations. Two months later symptoms of meningitis developed. The spinal fluid was purulent and contained diplococci. An opening was made through the squama, the dura was incised and purulent fluid escaped. Gauze was introduced between the base of the temporal lobe and dura. Subsequently the lateral ventricle was punctured and lumbar puncture was repeatedly performed. This desperate case recovered completely.

Heine considers the circumscribed and acute progressive varieties of purulent meningitis as curable, but the prognosis in the general type as absolutely bad. In the last the spinal fluid is nearly pure pus and contains

[1] Hinsberg, *l. c.*

[2] These ARCHIVES, vol. xxxv., No. 6, 1906.

bacteria; operation can accomplish nothing. At the Halle Ear Clinic an operation is not undertaken when the spinal puncture fluid is purulent and contains bacteria, and an operation under these circumstances is considered an error in judgment. Systematic writers regard cases of successful operation for otitic purulent meningitis as belonging to the acute progressive type even if the liquor contained bacteria and was purulent. It seems to me of very little practical importance how we classify these cases, as the variety of meningitis must sometimes depend upon the personal opinion of the surgeon as to the degree of purulency of the spinal fluid. Spinal puncture is of great importance as an aid to diagnosis and for prognosis, but the question of operation, it seems to me, should depend on other factors which are individual in each case, such as the patient's condition, the nature of the ear trouble, the findings at previous operation, etc.

Operative Treatment: Ballance[1] says that the main surgical indication is the removal of the local disease, and this surely should have been carried out before the meningitis had arisen. For general suppurative meningitis, according to this author, the indications for treatment are to suppress the source of infection, to give free exit to the suppurative exudation, and to combat the disease with the appropriate antitoxin. Friedrich[2] was one of the first to urge active operative measures in the treatment of meningitis. He suggested incision of the dura at the site of infection and making a counter-opening in the spine by laminectomy for drainage.

The prospect of successfully dealing with the localized intrameningeal infection depends somewhat on which fossa is first invaded. The broad exposure of the infected meningeal area if it is situated in the middle cranial fossa is simple; in all successful cases the operation was

[1] *Some Points in the Surgery of the Brain*, London: Macmillan & Co., 1907.

[2] *D. m. W.*, 1904.

performed in this region. The conditions in the posterior cranial fossa, where most meningeal infections begin, are much more complicated. The area can be rendered accessible, however, by the removal of the posterior surface of the petrous pyramid to the internal auditory meatus, sacrificing a portion of the labyrinth. Incision of the dura in this region also gives access to the cisterna magna, that distended portion of the subarachnoid cavity which would of course replace lumbar puncture. After the dura is broadly incised gauze tampons should be introduced in the subdural space, producing a form of "auto-irrigation." These operative procedures are not supposed to subject the patient to great danger and can therefore be undertaken before the advanced stages of the meningitis have set in.

The report of these successful cases is extremely encouraging, as it shows that something at least can be done with some hope of averting the usual outcome of purulent meningitis in the cases which do not rapidly become general. On the other hand, as Hinsberg, in the conclusion of his paper on this subject, says, the difficulties attending the localization, diagnosis, and after-treatment are so formidable that it requires an unusually fortunate association of favorable conditions to effect a cure.

It seems to me that just as in general surgery the advance in the treatment of peritonitis, as I have it on competent authority, is due to the more thorough elimination of the primary focus; so in the treatment of otitic meningitis, our aim should be directed to better eradicate the primary suppuration in the temporal bone, and that in many cases means the early recognition and proper surgical treatment of the labyrinthine suppuration.

REPORT OF THREE CASES OF INFECTIVE SINUS THROMBOSIS.[1]

By Dr. J. D. RICHARDS, New York.

Case 1.—Mrs. B., operated on at Far Rockaway, February 10, 1907. On January 26th, the patient was stricken with grippe and three days later an acute otitis of the left ear developed. An examination at the time revealed a reddened membrana tympani which was not bulging and an absence of mastoid tenderness; slight temperature attributable to the general infection. The drum was not incised. On the day following there was slight tenderness over the mastoid and considerable pain in this region. This disappeared quickly upon hot irrigation. There was no aural discharge. The patient continued depressed, and on February 8th she was seized with a chill. Temperature rose to 105° F., remitting to 102° F. A profuse sweat followed.

Five hours later there was a second chill. Temperature rose again to 105° F., remitting several degrees.

There had been a history of old malarial infection, but the blood examination proved negative and quinine was ineffective in controlling the recurring paroxysms, which repeated daily until February 10th, when I first saw the patient. Slight tenderness had now developed over the upper portion of the neck due to swollen glands, and this had aroused a suspicion that the ear might be the disturbing factor.

At this time the patient was profoundly septic—relaxed, clammy, and slightly jaundiced. The breath was heavy and the tongue thickly coated. Temperature 103° F.; pulse 120.

[1] Read at the meeting of the Section on Otology, N. Y. Acad. Med., April 12, 1907.

The membrana tympani was reddened but not bulging, and its appearance in itself would not have indicated the necessity for an incision. There was some moisture in the canal due to irrigation. The mastoid was nowhere tender.

Posterior to the mastoid tip, there was a slight but scarcely noticeable œdema. Eye-grounds were negative.

An operation revealed a perfectly sclerotic bone with the exception of a little diplōic structure at the tip. The antrum contained a few granulations but no pus. The sinus was far forward, and after its exposure from a point above the knee to its horizontal limb, was found normal in appearance. Palpation revealed nothing. The vessel was explored purely upon the symptoms.

A free flow from the torcular end occurred and the interior of this portion of the vein was normal in appearance. From the bulb end of the sinus, there was no flow whatever. After slitting open the external sinus wall well down toward the bulb, no clot could be seen in the deep horizontal limb. The wound was packed and a jugular resection was done. The vein appeared normal and was moderately well filled. Swollen glands were removed from the upper portion of the neck.

Upon returning now to the mastoid wound to remove the clot from the deep limb of the sinus, upon the removal of the gauze packing over the lower end of the opened vessel, a recent thrombus was extruded and this was followed by a profuse gush of blood from the bulb. No manipulation with the curette was necessary to dislodge the clot. This was accomplished by the reversal of the blood current. (The avenue of the jugular being closed, the flow from the tributaries to the bulb was diverted upward, carrying the clot before it.)

The day following operation the rigor was repeated, the temperature rising to 104° F. A sweat followed. From that time on there was a rapid decline in the temperature, and the further history of the case was uneventful.

Four days following operation, the wound was dressed. Pus issued from the deep horizontal limb of the sinus, and the external wall of the vertical sinus limb (portion of which was not removed at the time of operation owing to the

inconvenience caused by bleeding) had now assumed as far up as the knee a dirty-yellow purulent color, showing that the sinus wall though normal in appearance at the time of the operation had already become involved in a purulent phlebitis, which was unrecognizable.

The points of interest in a case of this character are numerous, particularly with reference to surgical technique.

First: The insidiousness of sinus thrombosis is illustrated. The absence of mastoid tenderness was in part due to the sclerotic character of the bone. At the same time the mastoid inflammation had practically subsided and the pathological condition of the bone would not of itself have warranted operation. Intracranial infection may appear, as I have on several occasions seen, weeks after the mastoid inflammation has subsided and the aural discharge ceased.

Second: When in a case of this character we are confronted with symptoms of septic absorption (other causes having been excluded) we must open the sinus as an exploratory measure purely upon symptoms, regardless of the physical signs—*i. e.*, of the color of the sinus, the presence of granulations upon the wall, the "feel" of the vessel, etc.—for the thrombus may be deeply situated in the horizontal limb, where a physical examination of the vessel is impossible. Delay in this instance would have been fatal, nor is this attitude in accordance with true conservatism.

Third: Had the attempt been made, after opening the vertical sinus limb, to dislodge the clot from the deep portion of the vessel with a curette before jugular resection, or had temporary pressure been instituted over the course of the jugular in the neck with the same purpose in view, both would have succeeded; a jugular resection would under these circumstances have appeared superfluous.

That a jugular resection is necessary where the deep horizontal limb or the bulb is involved (even though

the clot be extruded) was shown by the fact that four days after operation fluid was issuing from this part of the vein. In other words, the infected clot is not the only pathological factor with which we have to deal—a purulent phlebitis exists which continues to infect the contents of the vein at this point, and it is necessary to block from the general circulation this infected focus. Had the jugular vein not been removed the patient would have continued in sepsis.

Fourth: One of the dangers attending primary jugular resection is shown. Had the jugular been removed before opening the sinus, the currents tributary to the bulb would have been diverted upward, and the clot (which was recent and not firmly adherent) would have been dislodged and carried with the stream. We then would have had set free in the circulation an infected embolus of such great size that a disastrous result could scarcely have been averted. Upon opening the sinus, we then would have found no clot and would have thought the diagnosis mistaken.

The conditions which render primary jugular resection a dangerous procedure are: 1st, patulous tributaries to the bulb; and 2d, a loosely adherent clot (either recent or disintegrated), the site of which is above their point of entrance—that is, on their torcular side. These conditions existing, a primary jugular resection is a most dangerous procedure.

I have on several occasions seen clots gradually worked up from the deep horizontal limb of the sinus by the reversed pressure caused by a jugular resection diverting the currents of the tributaries to the bulb upward. It is a good idea to have an avenue of exit for such clots.

That the jugular bulb was not the site of the thrombus in this instance, but that the clot was confined to a point above the bulb, was shown by the fact that the upper portion of the jugular in the neck above the point of entrance of the facial was filled with blood (when the bulb

itself is blocked, the jugular vein above the point of entrance of the facial is, as a rule, collapsed), and again, by the fact that a return flow from the bulb was secured, showing that the tributaries thereto were not thrombosed. (When the bulb itself is the seat of thrombus we can, as a rule, get no return flow from the bulb, because this return flow is dependent upon the patency of the tributaries to the bulb, and the tributaries under the conditions mentioned are also blocked.) Cases of this character are frequently, but erroneously, reported as cases of primary jugular bulb thrombosis, in which, to explain the presence of the thrombus at this supposed point, it has been assumed that the route of infection is through the floor of the tympanum; but a consideration of the facts in these cases where a return flow from the bulb is secured after the removal of the thrombus rather convinces us that the jugular bulb itself, in the great majority of such cases, is not thrombosed, and that the location of the clot is in the deep horizontal limb of the sinus well above the bulb.

The reason for this portion of the sinus being a not infrequent site of thrombosis is apparent when with a magnifying glass we note (in a recent subject) the manner of distribution of the blood-vessels radiating from the antrum.

CASE 2.—A middle-aged woman, operated upon at the Manhattan Eye, Ear, and Throat Hospital, March 4, 1907, with the following history:

Five weeks previously she had an attack of acute mastoiditis of the right side accompanied from the first by symptoms of labyrinthine disturbance. A profuse aural discharge continued for about ten days, when it rather suddenly ceased. The mastoid tenderness had now disappeared, and but for the distressing vertigo and tinnitus she considered herself well. A few days prior to March 3d (the date of my first examination), the symptoms referable to the labyrinth, which had persisted up to this time, became greatly aggravated.

There were repeated vomiting, disturbed equilibrium, inability to stand, and intense high-pitched tinnitus; at the time of examination there was rotatory nystagmus, increased on looking to the healthy side. There was no hearing, and the fork tests were corroborative of labyrinthine disease. The labyrinth condition will be reported in a subsequent paper.

The ear examination revealed a dry canal with no inflammatory condition of the drum whatever, no mastoid tenderness, temperature 99⅘° F., pulse 100. The fundus of each eye was negative. There was marked prostration, and it was evident from the facies that the patient was ill and septic. Moderate headache was referred to the involved side.

The diagnosis of labyrinthine suppuration was made and verified by operation,—the oval window being the seat of fistula, the stapes having disappeared.

The findings in the mastoid were interesting in view of the fact that to all external appearances the inflammatory condition within the bone had long since subsided. There was no aural discharge, and had been none for weeks. There was no mastoid tenderness, and the drum was normal. The mastoid was opened—not with the expectation of finding it involved, but purely as a necessary step in approaching the labyrinth. There were found, however, scattered throughout the bone, numerous necrotic areas; a portion of the deep posterior canal wall separated as a sequestrum; parts of the tip and the pneumatic structure in the solid angle of the canals were necrotic; there were black congested areas which bled freely; there was no free pus present in the mastoid.

Following operation the temperature continued low, but without apparent cause the pulse became gradually accelerated, and during the next few days increased to 148 to the minute. Sugar had appeared in the urine subsequent to operation, but this did not satisfactorily account for the rapidity of the pulse. No conclusion could be drawn from the blood examination.

The patient's general condition improved satisfactorily, the mastoid wound and the interior of the labyrinth were covered with healthy granulations, and on March 22d the

patient was given permission to return to her home. The rapid pulse was still a puzzle.

On the afternoon of the same day the patient was seized with a chill, the temperature rose to 103° F., and a sweat followed. The wound was dressed and found healthy. A general examination failed to account for the symptoms. I then opened, at the time of dressing, the vertical sinus limb for exploratory purposes, and found it occupied by a disintegrated purulent clot which extended into the bulb. On pressing over the course of the jugular, the patient complained of no pain whatever, and there was no rigidity or cord-like swelling to be detected in the neck, although the condition later found upon operation would have led us to have expected both.

Under chloroform anæsthesia the thrombus was found to extend backward to the middle of the lateral sinus. Upon exposing the jugular, this vessel and the tissues immediately over its course were found glued in one common mass. The vein was a solid cord, yellow in color, and it stood out firmly as an artery; its sheath was greatly thickened. The tributaries to the jugular were so generally thrombosed that the operation was quite bloodless, no clamping of vessels being necessary. The thrombus extended throughout the jugular down into the thorax. At a point an inch above the clavicle the wall of the vein had softened and broken down, and the clot at this point was a collection of fluid pus. The vein was cut off behind the clavicle, no ligation being necessary. The stump of its cardiac end was seized with forceps and a large-sized ring curette introduced downward for the greater part of its length into the deep thoracic portion of the vessel, and an unsuccessful attempt made to establish a return flow from below. Much broken-down septic material was removed. During this manipulation there was repeated aspiration of air into the vessel, with no apparent ill result.

Several days later the wound was dressed and found purulent throughout; large quantities of pus drained down from the bulb into the neck wound; pus was issuing from the intrathoracic portion of the vein. The temperature continued high at about 104° F., with but slight variation, and in a few

days the patient succumbed to general sepsis. There were no metastases.

The thrombosis in this instance was of long standing, —as was shown by its extensive character, the condition of the tissues in the neck, the thickness of the walls of the vein and its sheath, the softened and broken-down vein wall in the lower portion of the neck, and by the fact that the thrombus removed from the lateral sinus contained a small concretion which was hard and gritty to the touch (the report of the chemical analysis of this concretion has not yet been received), yet with this increasing septic invasion the temperature continued low, rarely rising above 100° F. In this instance evidently the pulse was the more important guide to sepsis—we should respect it more as an index.

Case 3.—A child, eleven years of age, operated upon in the New York Eye and Ear Infirmary, March 11, 1907, with a history of long-standing chronic suppuration. The history of the present illness is somewhat indefinite. Two weeks prior to operation, pain in the left ear was complained of and slight discharge was noticed. On March 9th, the patient became delirious and the temperature, which from this time on was taken at irregular intervals, varied between 105° and 103° F. Mastoid tenderness was now for the first time noticed.

I first saw the child the day of operation, and examination revealed a bulging drum, sagging postero-superior canal wall, and an appearance of the fundus indicating an acute involvement of some duration, superimposed upon a chronic process. The antrum was very tender, the tip moderately so, the post-tip region negative. The neck was tender in the upper portion and decidedly stiff, but there was no retraction of the head. The patient was drowsy; the pupils contracted, their reaction normal; the fundus of each eye was negative. The reflexes were good.

The point of interest in the case was a horizontal nystagmus markedly increased when the eyes were directed to the

diseased side. When the eyes were directed to infinity or to the upper vertical meridian, the nystagmus was slight; when to the lower vertical meridian or to the normal side, it was absent. There was no history of vomiting. There was no inco-ordination, and the equilibrium was good.

By bone conduction all forks were lateralized to the involved ear; by air conduction the forks of the Hartmann set were heard throughout the scale, with a relative amount of shortening. Bone conduction was not shortened in duration. (A test of this character by no means excludes a serious involvement of the labyrinth in a suppurative process.)

Operation revealed a bone rather sclerotic for a child of this age; the mastoid involved throughout, and an absence of granulations; the antrum filled with thin, watery, stinking pus, mixed with white flakes; the aditus blocked by a plug of inspissated pus, which imbedded the horizontal limb of the incus; a stinking perisinus epidural abscess situated over the middle of the vertical sinus limb; the outer wall of the sinus purulent in color and free of granulations; a clot (mixed pneumococcus and streptococcus infection) extending from the knee of the sinus into the bulb, dark red in color and with numerous white purulent foci scattered through it; a mass of enlarged glands in the upper portion of the neck, and a jugular which was poorly filled, with the upper portion collapsed down to the point of entrance of the facial.

The tympanum was not disturbed at this operation, on account of the patient's general condition. Immediately following operation the nystagmus practically ceased, though for two days subsequent a faint oscillation could be seen when the eyes were directed to the operated side. The temperature quickly fell to 100° F. The pulse continued rapid, 140 to the minute.

Shortly afterward the radical operation was completed, and there was nothing found in the tympanum to make clear the cause of the nystagmus.

In this instance the nystagmus differed from that which is usually associated with labyrinthine suppuration, in that in the latter cases the oscillation is, as a rule, most marked when the eyes are directed to the extreme lateral position

of the normal side. As to why the first operation—which was confined to the mastoid, the sinus, and the jugular—should have caused a disappearance of the nystagmus, is not apparent. The further history of the case was uneventful.

A CASE OF SEROUS MENINGO-ENCEPHALITIS, WITH AUTOPSY REPORT.

By Dr. ALBERT BLAU, Goerlitz.

Translated from *Zeitschr. f. Ohrenhlk.*, Vol. LII., p. 129, 1906.

THE lack of definite autopsy findings, as Koerner has stated in the last edition of his book on *Otitic Diseases of the Brain*, etc., has not permitted the recognition of serous meningitis as a distinct disease consecutive to purulent otitis.

It seems of interest to report a case of this kind where an autopsy was performed.

E. K., two and three-fourths years old, two weeks before Christmas was taken ill with measles. On January 1st pain began in the right ear, followed by discharge, loss of appetite, general depreciation of health, gradual loss of eyesight and of hearing, left-sided ptosis, occasional convulsions in the left arm and the left leg, with moderate rise of temperature.

The eyes were examined on January 19th.

In the right eye the pupil is round, sluggish. The disk is pale and the arteries thin.

Left eye: the upper lid hangs down, pupil moderately dilated, irresponsive; the optic nerve the same as in the other eye.

On January 26th, I had the opportunity of examining this child, and found an emaciated, somnolent, pale child with some difficulty in breathing. T. 38° C. Pulse 60–80. The lungs and heart are normal. Reflexes absent. No rigidity of neck. Abdomen retracted. Incontinence of

fæces and urine. Urine normal. Right auditory canal contains fetid discharge. The drum is almost completely absent. Mucous membrane in the tympanum granular. No mastoid symptoms.

No lumbar puncture was performed.

On January 20, 1905, the antrum was opened. There was no pus. The mucous membrane was swollen and granular. A part of the carious posterior wall was removed. The middle fossa was exposed to an extent of 1*cm*. The dura was tense, of a grayish-white color, slightly injected. After incising the dura, the brain was punctured in three directions without finding any pus, though a large quantity of clear fluid was evacuated on each insertion of the knife.

The sigmoid sinus and the posterior fossa were exposed. Incision gave the same result as in the middle fossa.

Eight hours later the left eyelid could be somewhat raised. Death followed eighteen hours afterward.

Autopsy.—The dura moderately injected and very tense. The longitudinal sinus contains coagulated blood. The pia is transparent, slightly anæmic. The pial vessels are very thin. The convolutions are unusually flattened. They are carefully examined but no evidence is found of cloudiness or adhesions, no tubercles and no pus. The brain substance is of moderately firm consistency. A few bleeding points in the medullary substance. Both lateral ventricles are enormously dilated. They would accommodate three-fourths of a child's fist. The adult thumb could easily be introduced into the dilated horns. The thalami and the corpora striata are flattened. The third ventricle is also dilated. There is a great deal of watery fluid.

There are a number of points in this case confirming the diagnosis of purulent meningitis, which was originally made by the family practitioner, namely, the paralysis, the incontinence, the retraction of the abdomen, but there was no rigidity of the neck, only moderate variation in temperature, no contracture, free mobility of the head, and the condition of the pulse. The condition found in the ear shows that the otitis was not acute. The

absence of the drum, the granular tympanic mucous membrane, the kind of discharge, the destruction of the posterior canal wall, all point to a chronic otitis, though we must remember that frequently after acute infectious disease otitis occurs with a rapid disintegration of bone. The possibility of the presence of an abscess justified an operation. The conditions found at operation suggested a serous meningitis—the enormous quantity of clear fluid evacuated on puncturing the brain. This supposition was confirmed at autopsy.

All the conditions which Boenninghaus suggests for the diagnosis of acute internal serous meningitis were present:

1. There was no fresh purulent meningitis or residua, no tuberculous meningitis, no tumors or abscesses.
2. The ependyma was not thickened and not clouded.
3. The brain was subjected to a fatal compression.

Among the cases which Boenninghaus describes there are a number which apparently were caused by measles.

In our case the measles infection seems to have run its course. The severe trouble seemed to follow a relapse of an otitis caused by measles.

The course of the disease makes the presence of an inflammatory hydrops of the ventricle probable. All the symptoms caused by this increased liquor came on in a relatively short time after good health. The connection of the cerebral disease with the ear condition is evident. In most cases of serous meningitis there is a pronounced optic neuritis.

The mydriasis of the left pupil occurring forty-two hours before death is a comparatively frequent symptom due to an encephalitis or to increased intraventricular pressure. I think our case is to be regarded as one of acute internal serous meningitis with encephalitis. It seems probable that the encephalitis did not occur until towards the close of the affection. The operation and the autopsy did not reveal caries of the bone leading to

the dura. There is, therefore, no direct communication between the primary disease of the temporal bone and the interior of the skull. A direct bacteriological infection can hardly have caused disease of the meninges, and the case can probably be regarded as confirming Merkens's suggested explanation of serous meningitis, that it is a disease caused by toxic agents. At the same time, measles can hardly be regarded as the cause.

This condition was found, as is usual, in youthful individuals, our patient being two and three-fourths years old.

ANOTHER CASE OF OTITIC PURULENT SINUS THROMBOSIS WITHOUT FEVER.

By Dr. HERMAN SCHROEDER, Erlangen.

Translation from *Zeitschr. f. Ohrenhlk.*, Vol. LII., p. 357, 1906.

ALEXANDER'S case (which appeared in *Arch. f. Ohrenheilk.*, 1905, p. 89) has led me to publish the following, which is similar on account of the afebrile course of the sinus phlebitis.

The case-history is as follows:

P. M., forty-nine years of age, was admitted on July 4, 1905. Nine years ago he suffered a severe injury to the head and to his ribs by falling from the roof of a building. In February, 1905, pain was experienced in the left ear and behind the ear. There had been no previous otorrhœa. Two weeks later the ear discharged. The pain grew less, but persisted behind the ear. He was treated by a specialist and the condition improved somewhat, until in July it again grew worse. The patient complained of tinnitus, deafness, occasional vertigo, and vomiting.

On examination; large well-built man. Pupils react promptly. Ocular movements normal. No nystagmus. Eye-grounds normal.

Right ear: *Mt* opaque.

Left ear: there is a large quantity of purulent, fetid pus in the canal. The upper wall is depressed. The drum is red, bulging in its posterior half. Some infiltration about the apex of the mastoid process, tenderness over the antrum and at the apex. The glands below the mastoid process are enlarged and tender.

Whisper is perceived: right in 1 ½ *m*; left ½ *m*.

T. 37.5° C. Pulse 80.

The pus contained staphylococci.

Operation July 7th: The antrum contained pus. The sinus was exposed and found covered with discolored granulations. Pus exudes from the sinus through an opening large enough to admit a thumb. The sinus is further exposed and pus is found between the sinus wall and the sulcus. The opening into the sinus is enlarged and the sinus cavity is shut off above and below by a firm thrombus. The wound and the sinus are packed with vioform gauze.

July 8th, T. 37°–37.9° C.

July 9th, T. 37°–37.2° C.

July 10th to the day of his discharge, August 8th, T. varied between 36° and 37° C.

The recovery was otherwise uneventful.

The similarity between our case and that of Alexander consists in the afebrile course during the entire period of observation of this case. A decided difference in the two cases is to be found in the bacteriological conditions. In Alexander's case the bacteriological examination showed gram positive diplococci in the pus of the abscess and in the thrombus, frequently with typical capsules; culturally the colonies were those of the diplococcus characterized by an unusual mucoid condition in agar, corresponding in other biological and cultural characteristics with the diplococcus of pneumonia. It is impossible to say whether this diplococcus is different from the true diplococcus of pneumonia and is responsible for the unusually mild course of the thrombosis.

In our case repeated examination revealed the presence of the staphylococcus pyogenes aureus.

The afebrile course in the two cases can be explained by the previous history and by the good general condition of the patients. In both cases the ear trouble had existed for months and the patients were very healthy individuals. The local trouble had existed for quite a

long time and the protective powers of the patients prevented the infection becoming general. In Alexander's case a layer of granulations *3mm* thick was situated on the dura and there was a firm thrombus in the sinus. In our case the dura of the cerebellum was not involved, while the blood current in each direction was shut off by a firm thrombus. Owing to the favorable conditions found at the time of operation no treatment was decided upon.

REPORT OF THE TRANSACTIONS OF THE SECTION ON OTOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

REGULAR MEETING, APRIL 12, 1907. DR. WENDELL C. PHILLIPS, CHAIRMAN.

Report of a case of diphtheria, complicated by acute mastoiditis and infective sinus thrombosis. P. D. KERRISON, M.D. (Published on pp. 412–415 of this issue.)

Report of a case of occlusion of the external meatus in an infant, the result of forceps delivery. W. H. HASKIN, M.D.

Harold Lyon, seventeen months of age, first came to the Manhattan Eye and Ear Hospital, February 19, 1906. At that time he was three months old and apparently a strong healthy child. He had an ulcer just behind and below the tragus, which the mother said was caused by forceps used in her delivery. As this was the only thing which had attracted the mother's notice, I did not look farther, but succeeded in healing the ulcer very promptly.

Six weeks later he was brought back with an apparent earache. On examination I found an almost complete occlusion of the external meatus. With difficulty I succeeded in introducing the smallest Eustachian bougie, and found the occlusion to be only at the meatus. By increasing the size of the bougie gradually, I succeeded in getting quite an opening—only to have him disappear for a year.

April 1, 1907, he returned with a history of recurrent discharge from the ear, of a watery nature. The opening had almost closed again, but probing with lachrymal probes

gradually increased the size. I have the mother now use daily the No. 12 Bowman. I purpose to dilate still farther and then to introduce a short hard-rubber tube, and in this way try to overcome permanently the obstruction.

The question of interest is one of congenital occlusion or the result of traumatism in delivery. The fact that the child had an extensive laceration behind and below the tragus would incline to the latter view. The child had never had any running from the ear. It was only six weeks after first coming to the hospital that I introduced a bougie and found the fluid in the canal. The child at that time had an adenitis and was suffering from absorption of pus. The mother did not bring him back until two weeks ago, but has been using the probe, and it is now comparatively open. The fact that the band of obstruction appears to spring from the anterior canal wall made me suspect the possibility of a congenital occlusion, even without other deformity of the ear.

Discussion: Dr. DUEL said that the lesion was probably traumatic.

Dr. PHILLIPS said that he had never seen a case of occlusion without deformity of some kind in the auricle. One of his own connections has an infantile ear, perfect in shape, but it has never grown, has no external canal, but the Eustachian tube is normal. He thought that this case must be traumatic in origin.

Dr. HASKIN said that the only thing that made him feel that the case might not be traumatic was the fact that the opening was along the posterior wall. The band closes the external meatus. There is practically along the anterior wall a membranous band over which you can hook a probe, and it looks like a false membrane.

Presentation of a case of displacement of the auricle by a tumor. WENDELL C. PHILLIPS, M.D.

This little patient who has a large tumor, involving a portion of the head, face, and neck, is eleven years of age. The mother did not observe the growth until the child was two years old, or about the time when she began to take solid food. At that time the mother noticed that whenever the child ate, especially anything sweet, there was a flush of the whole side of the face, and that has kept up all these years,

excepting that at the present time only the upper portion of the neck and face becomes red when she eats sweets. Dr. Phillips himself had never witnessed this phenomenon, but the mother states that it always occurs. He was not sure that this had any influence in the case, although it might have. In response to an inquiry as to whether the tumor itself became red, Dr. Phillips said that the mother of the child informed him that only the upper part of the face was so affected. The little girl is a child of good ordinary intelligence and in fair general health. Since two years of age the swelling has increased gradually in size. The growth evidently begins at about the centre of the ramus of the jaw and extends along the face, involving the ear, so that a large portion of the neck and even of the mastoid region is affected. It has completely separated the membranous from the bony attachment of the external ear. You can see that from the way it droops. and still the external auditory canal remains intact. Hearing is not affected. Examination of the mass shows it to be a very soft, almost pultaceous tumor. When first seen it was thought that it might be a benign fatty growth. The only points that lead to the belief that it may be something else are the flush, and that on deep palpation there is sensation as of some enlarged blood-vessels. Whether it was a kind of nævus or some sort of fatty tumor, Dr. Phillips could not say, and he expressed himself as anxious to have some light on the subject. If the growth were removed, it would not be difficult to anchor the ear, and it might be advisable to make an incision and remove the growth.

Discussion.—Dr. JOHNSON inquired whether there was any bruit on auscultation, to which Dr. PHILLIPS replied that he had not observed any.

Dr. WILSON inquired whether there was any pressure on the carotid.

Dr. JOHNSON questioned whether any surgical procedure could be effectively done. It would be a very extensive operation, and he thought that some form of electrolysis might be used to advantage, and later change the position of the ear by operation. Before any conclusion was reached, however, it would be well to make a very critical examination of the case, and this examination should include the use of

the stethoscope, pressure on the carotid, to ascertain the state of the venous supply: and if it was finally concluded that it was an angiomatous tumor, he thought that the best treatment primarily would be electrolysis. It was a rather large angioma to be treated in that way, but he had seen one situated on the nose and cheek disappear under electrolysis. Most writers, however, do not favor electrolytic treatment on tumors larger than a hazel-nut, but as this case extends over so large a surface and would require such an extensive surgical procedure, it might be well to try it before proceeding to the more extreme measures.

Dr. COBURN suggested that there were two other ways of operating on such a case—one being Dr. Wyeth's method of injection of boiling water, and the other the injection of absolute alcohol. These methods have been used very successfully in certain vascular tumors. This is a very large tumor, but these methods of treatment ought to be borne in mind as by their use the disfigurement of scars is avoided.

Dr. SMYTH said that it seemed to him that if this was an angiomatous tumor pressure would produce more effect upon it. Pressing upon the tumor does not interfere with it in any way and does not appear to reduce the size.

Dr. DENCH said that as the tumor had been present for nine years he hardly thought it was an angioma. He would expect an angioma of this extent to increase in size more rapidly. He would also expect to find more enlargement of the superficial vessels. The change in color which was observed during mastication was one which might be caused by any growth in this region, angiomatous or otherwise. The blushing of the integument over the growth during mastication could easily be caused by pressure upon the vasomotor nerves. There was a certain portion of the growth behind the ear which upon palpation seemed to suggest angioma. If, however, this peculiar feeling were due to blood-vessels, there would certainly be more superficial injection. Dr. Dench was inclined to consider the mass a lipoma. Considering the fact that the mass lying in the concha would have to be removed, it seemed to him that the best procedure would be to remove this first, by dissection, thus correcting the deformity caused by this mass, while at the same time

the operator would be able to determine exactly the nature of the tumor. If the growth were lipomatous, it could probably be extirpated, and if angiomatous, the best procedure would be excision of the external carotid and its branches.

Dr. PHILLIPS said that his mind had not inclined to angioma at first, for it seemed to him that an angiomatous growth would show more on the surface; but when the mother told him of this flush, a later examination led him to think of that as a possibility. He appreciated the suggestions that had been made, and intended to take up the case carefully and decide upon some method of procedure soon.

The herpetic inflammations of the geniculate ganglion and their complications in the aural region. J. RAMSAY HUNT, M.D. (Published on pp. 371-381 of this issue.)

Discussion.—Dr. DENCH said that he had seen one case of this kind, where the disease had complicated an acute otitis, which finally went on to mastoid infection, requiring mastoid operation. The cause of the acute otitis was the use of the nasal douche. The mastoid symptoms developed seventy-two hours after the beginning of the acute otitis. The mastoid operation was performed in this instance. The pain through this entire attack had been unusually severe. Two days after the mastoid operation, the pain still remaining severe, a vesicular eruption appeared upon the auricle. With the subsidence of this eruption, the pain disappeared, and the case made a rapid recovery. In this instance, the pain preceding the eruption was typical. Dr. Dench had seen one or two other cases. In one case there was a history of pain in the ear, and although the case was not seen during the vesicular stage, the scars marking the site of the vesicles could be easily seen.

Dr. JOHNSON inquired whether these cases had been reported.

Dr. DENCH replied that the case of mastoiditis had not been reported, but that one of the other cases had been mentioned in his book.

Dr. ARNOLD KNAPP said that he had been very much interested in the paper, especially in the group of cases which Dr. Hunt had described in which the cutaneous eruption has a different area from the ear involved, and he would like to

know if, in those cases where the herpes was in the occipital, neck, or ophthalmic region, the aural disturbances were preceded by a herpes of the auricle, for it seemed to him, if he understood Dr. Hunt correctly, that an involvement of the geniculate ganglion first shows itself by herpes of the auricle. If the herpes is present in a different distribution, why should the facial be involved without herpes of the auricle? He also inquired whether in Dr. Hunt's pathological investigations the auditory nerve had been examined, and whether this nerve was found involved either by pressure or by direct inflammatory extension, and whether the vestibular branch or the cochlear branch was affected.

Dr BRYANT said that he had been very much interested in this subject, and in his experience, covering twenty years, during which he had seen more than 20,000 patients, he had seen four or five of these cases, all of them at the Eye and Ear Infirmary in Boston. In most of the infirmaries with which he had been connected, it was the custom to put down the chief or common diagnosis, the minor or rarer complications like herpes not being put down, and in that way probably a great many cases have been left off the records. Dr. Bryant saw a case this summer, with Dr. Hunt. The case was not seen till after the herpes had disappeared, but the nerve lesion persisted.

Dr. RAMSAY HUNT, in closing the discussion, referred first to Dr. Dench's case and said that herpes of the auricle secondary to, or at least associated with, otitis media, is a rare complication. These cases he had not included in his series. The series of sixty-one cases presented in his paper were all uncomplicated cases of herpes, *i. e.*, true herpes zoster, and there was no question of any secondary manifestation. While the true herpes zoster is dependent upon ganglionic inflammation, there is undoubtedly a neuritic form of herpes, such as follows injuries and inflammations of the nerve trunks; so that in cases of suppurative otitis media with a complicating zoster the sensory nerves innervating the auricle and the canal may be invaded by the inflammatory process, and thus secondarily give rise to zoster of neural and not ganglionic origin.

In regard to the pathology, one of his cases, which he

had not alluded to in his remarks, died 87 days after the appearance of the eruption. The herpes was distributed over the head, neck, and ear (herpes occipito-collaris et auricularis), and was distinctly a double manifestation of zona. A careful study was made of the spinal ganglia, the spinal cord, the medulla, the facial nerve, and the nerve of Wrisberg. The secondary typical changes were found in the tip of the third spinal ganglion and in the spinal cord, and in the posterior root of the third cervical nerve, as have been described in other cases of this affection. An attempt to remove the geniculate ganglion was made, but was unsuccessful. The facial nerve and the nerve of Wrisberg were studied, however, by the osmic-acid method, which is a very sure one, and the same secondary changes were found in the nerve of Wrisberg and its intramedullary root in the medulla as were found in the third cranial nerve root and the spinal cord. These secondary changes in the nerve of Wrisberg or the afferent root of the seventh nerve indicate that the geniculate ganglion was involved. In this case the auditory nerve was not affected clinically, so that it was not subjected to any examination.

Replying to Dr. KNAPP: In his series of sixty-one cases with herpes of the face, neck, and ear, and complicating facial palsy, auditory symptoms were present in twenty-one. Of these cases with acoustic symptoms, nine had a herpes occipito-collaris, four herpes facialis, and seven herpes auricularis. In this latter group the herpetic vesicles were confined to the region of the concha and auditory canal In herpes zoster in general, the skin manifestation is usually a single one, corresponding to the cutaneous zone of a single spinal ganglion. This is, however, not always the case, and multiple involvement of the ganglia is shown clinically in the double, triple, and bilateral forms. There is also no question that inflammatory changes may be present in the ganglion adjacent to the chief focus, which gives rise to the cutaneous manifestation. As the Gasserian, geniculate, and second and third cervical ganglia represent a more or less continuous series of ganglia in the cephalic extremity, it would seem reasonable to presume that a marked herpetic focus in one would also be accompanied by an inflammatory

reaction in the other ganglia of this group, of a like nature but of a lesser degree, thus explaining the presence of facial palsy and acoustic symptoms due to a geniculate ganglion inflammation, when the real zoster recurs in the face or neck, *i. e.*, the Gasserian or cervical representations, the geniculate zoster zone itself being quite free. It may also be remarked that the geniculate zoster zone is small and a very slight eruption might be overlooked in comparison with the chief eruption in the other areas. For the complete elucidation of this point, the exact clinical studies of the future will be required.